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EPA Superfund
Record of Decision:

BASIN MINING AREA
EPA ID: MTD982572562
OU 01
BASIN, MT
03/30/2001

Record of Decision

Town of Basin Project
Operable Unit 1
Basin Mining Area
Jefferson County, Montana

U. S. Environmental Protection Agency
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Helena, Montana 59626

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Helena, Montana 59620-0901

March 2001

Record of Decision
Preface

Town of Basin Project
Operable Unit 1
Basin Mining Area
Jefferson County, Montana

The U. S. Environmental Protection Agency (EPA), in consultation with the Montana Department of Environmental Quality (DEQ) presents this Record of Decision (ROD) for Operable Unit (OU) 1 of the Basin Mining Area National Priority List (NPL) Site in Jefferson County, Montana. The ROD is based on the Administrative Record for OU1 including the Remedial Investigation (RI), the Feasibility Study (FS), the Human Health Risk Assessment (HHRA), the Proposed Plan, the public comments received, and EPA responses. The ROD presents a brief summary of the RI and FS, actual and potential risks to human health and the environment, and the selected remedy. EPA has followed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Contingency Plan (NCP), and EPA guidance (EPA 1999a) in preparation of the ROD. The three purposes of the ROD are to:

1. Certify that the remedy selection process was carried out in accordance with the requirements of the CERCLA and, to the extent practicable, the NCP;

2. Outline the engineering components and remediation requirements of the Selected Remedy; and

3. Provide the public with a consolidated source of information about the history, characteristics, and risk posed by the conditions of OU1, as well as a summary of the cleanup alternatives considered, their evaluation, the rationale behind the Selected Remedy, and the agencies' consideration of, and responses to the comments received.

The ROD is organized into three distinct sections:

1. The **Declaration** section which functions as an abstract for the key information contained in the ROD and is the section of the ROD signed by the EPA Regional Administrator.

2. The **Decision Summary** section which provides an overview of OU1 characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the Selected Remedy and explains how the remedy fulfills statutory requirements.

3. The **Responsiveness Summary** section which addresses public comments received on the Proposed Plan, the RI, the FS, and other information in the Administrative Record.

Declaration

Site Name and Location

Town of Basin Operable Unit 1
Basin Mining Area NPL Site
Jefferson County, Montana
CERCLIS ID No. MTD 982572562

Statement of Basis and Purpose

This decision document presents the Selected Remedy for the Town of Basin Operable Unit (OU) 1 of the Basin Mining Area NPL Site in Jefferson County, Montana. The Environmental Protection Agency (EPA), in consultation with the Montana Department of Environmental Quality (DEQ), selected the remedy in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act (collectively, CERCLA) and the National Contingency Plan (NCP).

This decision is based on the Administrative Record for OU1 of the Basin Mining Area Superfund Site. The Administrative Record and copies of key documents are available for review at the EPA Montana Office, located at 301 S. Park, Room 192 in Helena, Montana and at the Boulder Community Library, located at 202 S. Main Street, in Boulder, Montana.

Assessment of the Site

The response action selected in this ROD is necessary to protect public health from actual or threatened releases of hazardous substances, pollutants, or contaminants from the OU1 site, which may present an imminent and substantial endangerment to public health or welfare or the environment.

Description of the Selected Remedy

This ROD specifically addresses OU1, one of two operable units within the Site identified as source areas. The other operable unit, Basin Watershed, will address contamination related to mining activities within the Basin Creek, Cataract Creek, and Upper Boulder River watersheds. OU1 includes residential soils contaminated with mine wastes as well as streamside tailings, Jib tailings, and other source areas in Basin, Montana.

The Selected Remedy for OU1 is the Removal/Transportation/Disposal (Luttrell Repository)/ Institutional Controls Alternative, which was presented in the Final Feasibility Study Report (FS)(CDM Federal Programs Corporation [CDM Federal], 2000a). The Selected Remedy incorporates minor modifications from the alternatives presented in the FS. The FS evaluated and screened remedial alternatives for contaminated residential soils and mine waste. The FS used a comparative analysis to evaluate five alternatives and identify the advantages and disadvantages of each alternative. Selection of the Removal/Transportation/ Disposal (Luttrell Repository)/Institutional Controls Alternative was based on this analysis.

The Selected Remedy for contaminated residential soils and mine waste includes the following features:

- Excavation, transportation, and disposal of contaminated residential soil and mine waste from the town of Basin to the Luttrell Repository.
- Backfill of excavated areas with clean soil and revegetation of these areas.
- Implementation of institutional controls, which are measures to control exposure to areas where removal of mine waste may not be feasible (under structures, etc.), if risks associated with such mine waste are identified.

The Selected Remedy is protective of human health and the environment through the following:

1. All of the contaminated soil will be removed from the residential yards, the streamside tailings, Basin Street Tailings, the Jib Tailings, and the source areas near the wastewater treatment plant. The ore pile located north of Basin and the upper 2 feet of contaminated soil beneath this pile will also be removed.

2. All excavations will be backfilled with clean soil and revegetated, preventing direct exposure of the Basin residents to contaminants in surficial soil.

3. Removal and placement of the waste material in the Luttrell Repository will control both erosion and airborne transport of contaminants in the town. Removal will also reduce leaching and migration of contaminants from mine waste into groundwater and erosion of contaminants into surface water.

4. While the removal of waste material could cause a short-term exposure to airborne contamination during excavation and transportation, this exposure will be reduced by dust control measures implemented during the actual construction of this Selected Remedy.

5. The institutional controls component of this alternative for mine waste (proprietary controls, information, and educational programs) will continue to control direct exposure to the contaminants that may be inaccessible, if risks associated with such mine waste are identified.

Statutory Determinations

The Selected Remedy attains the mandates of CERCLA §121 and, to the extent practical, the NCP. Specifically, the Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy uses permanent solutions (e.g., removal to an offsite repository and backfill) to the maximum extent practicable. Because this remedy could result in hazardous substances, pollutants, or contaminants remaining onsite in inaccessible areas above levels that allow for unlimited use and unrestricted exposure, a review will be conducted, if necessary, within 5 years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. This remedy is acceptable to both the State of Montana and the community of Basin.

ROD Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record for this site.

- Contaminants of concern (COC) and their respective concentrations.
- Baseline risk represented by the COCs.
- Cleanup levels established for COCs and the basis for these levels.
- Techniques for addressing source materials that constitute principle threats.
- Current and reasonably anticipated future land use assumptions used in the baseline risk assessments and ROD.
- Potential land use that will be available at the site as a result of the Selected Remedy.
- Estimated capital costs, annual operation and maintenance costs, total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

_____ _____

Max H. Dodson Date
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
U. S. Environmental Protection Agency, Region VIII

_____ _____

Jan P. Sensibaugh Date
Director
Montana Department of Environmental Quality

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Acronyms

ARARs	applicable or relevant and appropriate requirements
BAF	bioavailability factor
bcy	bank cubic yards
bgs	below ground surface
CDI	chronic daily intake
CDM	Federal CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminants of concern
COPCs	chemicals of potential concern
CSF	cancer slope factor
CTE	central tendency exposure
cy	cubic yards
DEQ	Department of Environmental Quality
DQO	data quality objective
E&E	Ecology and Environment, Inc.
EPA	U. S. Environmental Protection Agency
ESI	Expanded Site Inspection
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HQ	hazard quotient
HRS	Hazard Ranking System
IEUBK	Integrated Exposure Uptake Biokinetic
MDHES	Montana Department of Health and Environmental Services
MDSL	AMRB Montana Department of State Lands, Abandoned Mine Reclamation Bureau
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operations and Maintenance
OU	Operable Unit
PA	Preliminary Assessment
ppm	parts per million
PRG	preliminary remediation goal
PRP	potentially responsible party
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SCEM	Site Conceptual Exposure Model
SSI	Screening Site Inspection
UCL	upper confidence limit
UOS	URS Operating Services
WWTP	Wastewater Treatment Plant
XRF	X-ray Fluorescence
mg/kg	milligram per kilogram
µg/dL	micrograms per deciliter
µg/L	micrograms per liter

Section 1
Site Name, Location, and Description

Town of Basin Operable Unit 1
Basin Mining Area NPL Site
Jefferson County, Montana
CERCLIS ID No. MTD 982572562

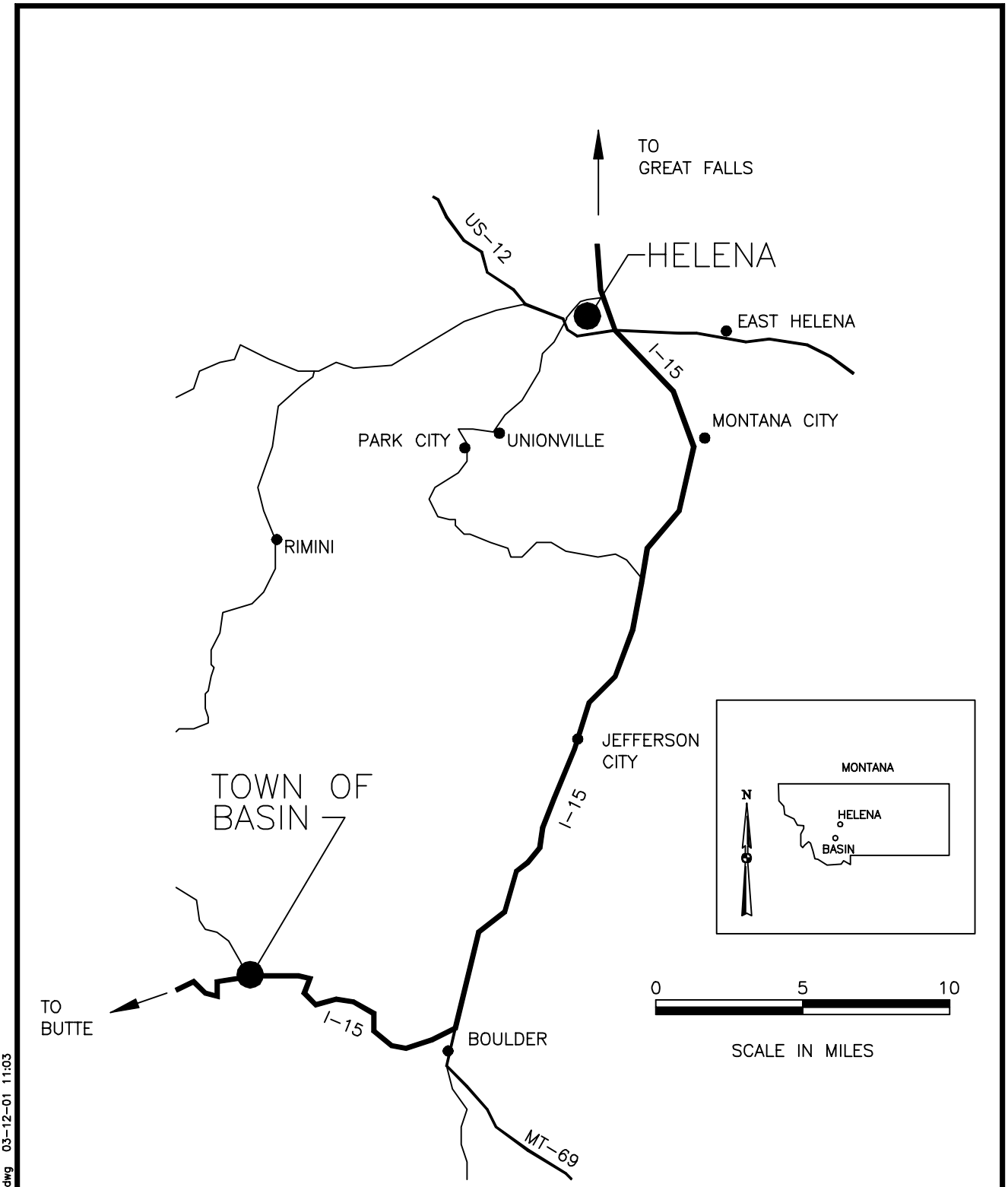
The Basin Mining Area Superfund Site is located within and around the town of Basin in Jefferson County, Montana (Figure 1). The Basin Mining Area Superfund Site has been organized into two operable units (OU): the community of Basin, Montana (Town of Basin OU1), and the surrounding watersheds of Basin Creek, Cataract Creek, and part of the upper Boulder River (Watershed OU2). The community of Basin is located in Sections 17 and 18, Township 6 North, Range 5 West in the Basin quadrangle (Figure 2). The coordinates of the site are approximately 46˚ 16'10" north latitude and 112˚ 16'46" west longitude (Ecology & Environment [E&E] 1991).

The U. S. Environmental Protection Agency (EPA) is the lead agency for the site and Montana Department of Environmental Quality (DEQ) is the support agency. The source of funding for cleanup of this site will be the Superfund trust fund with DEQ providing 10 percent of the cleanup costs and 100 percent of operation and maintenance.

This Record of Decision (ROD) addresses all of the Town of Basin OU1. OU1 includes contaminated residential soils, a former smelter area, streamside tailings, several tailings piles spread throughout town, and a mill site as shown in Figure 3.

The town of Basin, an unincorporated municipality, is located within the Boulder River watershed. The river trends west to east through the town. The town’s boundary exists on both sides of the Boulder River at the mouth of the Basin Creek watershed. Basin Creek flows directly through the town of Basin, joining the Boulder River on the south side of town. Kleinsmith Gulch flows north into the Boulder River on the southwest end of the town. Cataract Creek flows south and joins the Boulder River, approximately 1 mile east of town.

The town is situated at an approximate elevation of 5,350 feet above mean sea level within the watershed valley. Steep foothills rise approximately 500 feet above the surrounding valley on the east and west sides of Basin Creek and the south side of the Boulder River. Interstate Highway 15 crosses the town in an east-west direction and generally parallels the Boulder River within the watershed valley.



Town of Basin Basin, Montana	Location Map	Figure No. 1
CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*		3/01

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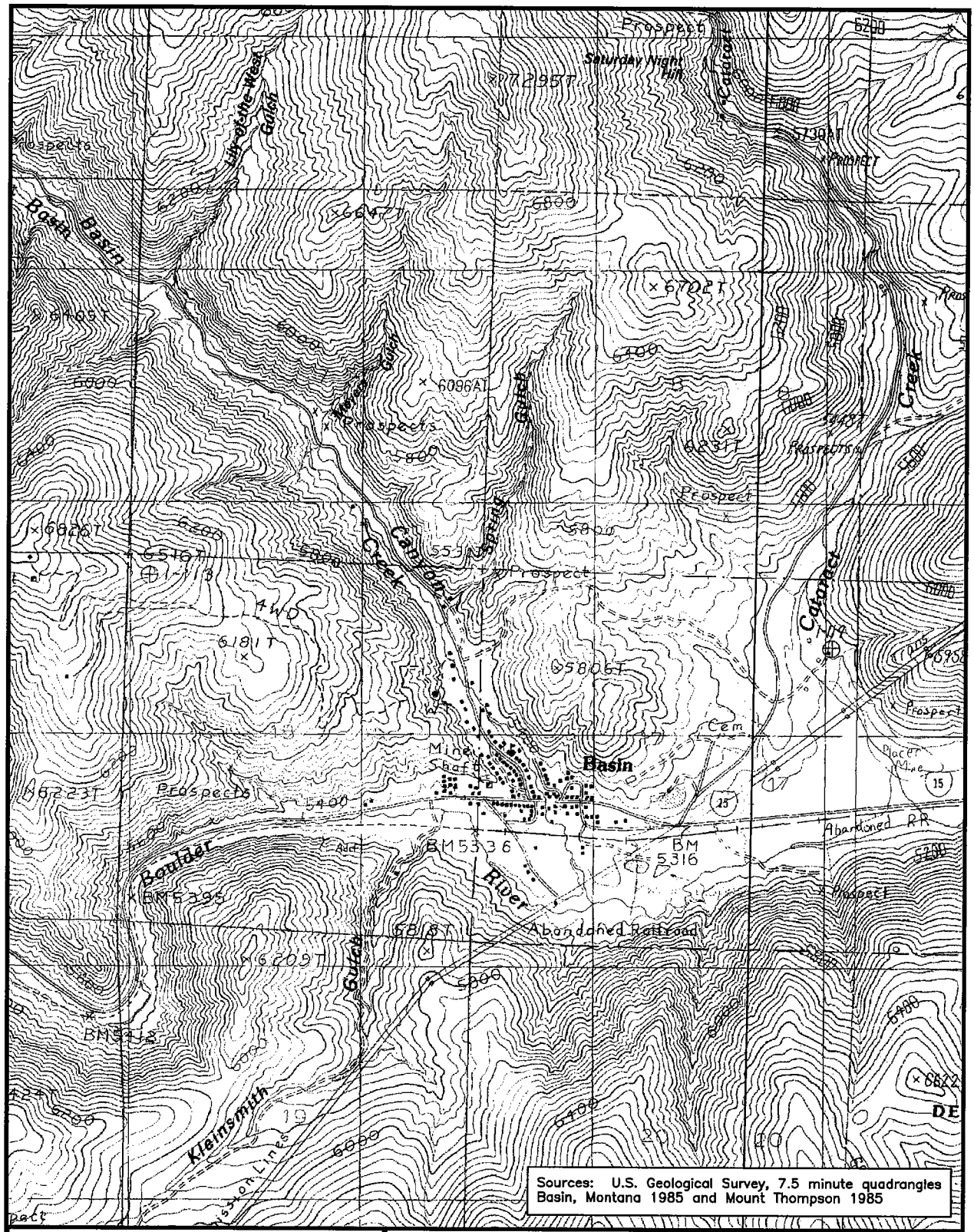
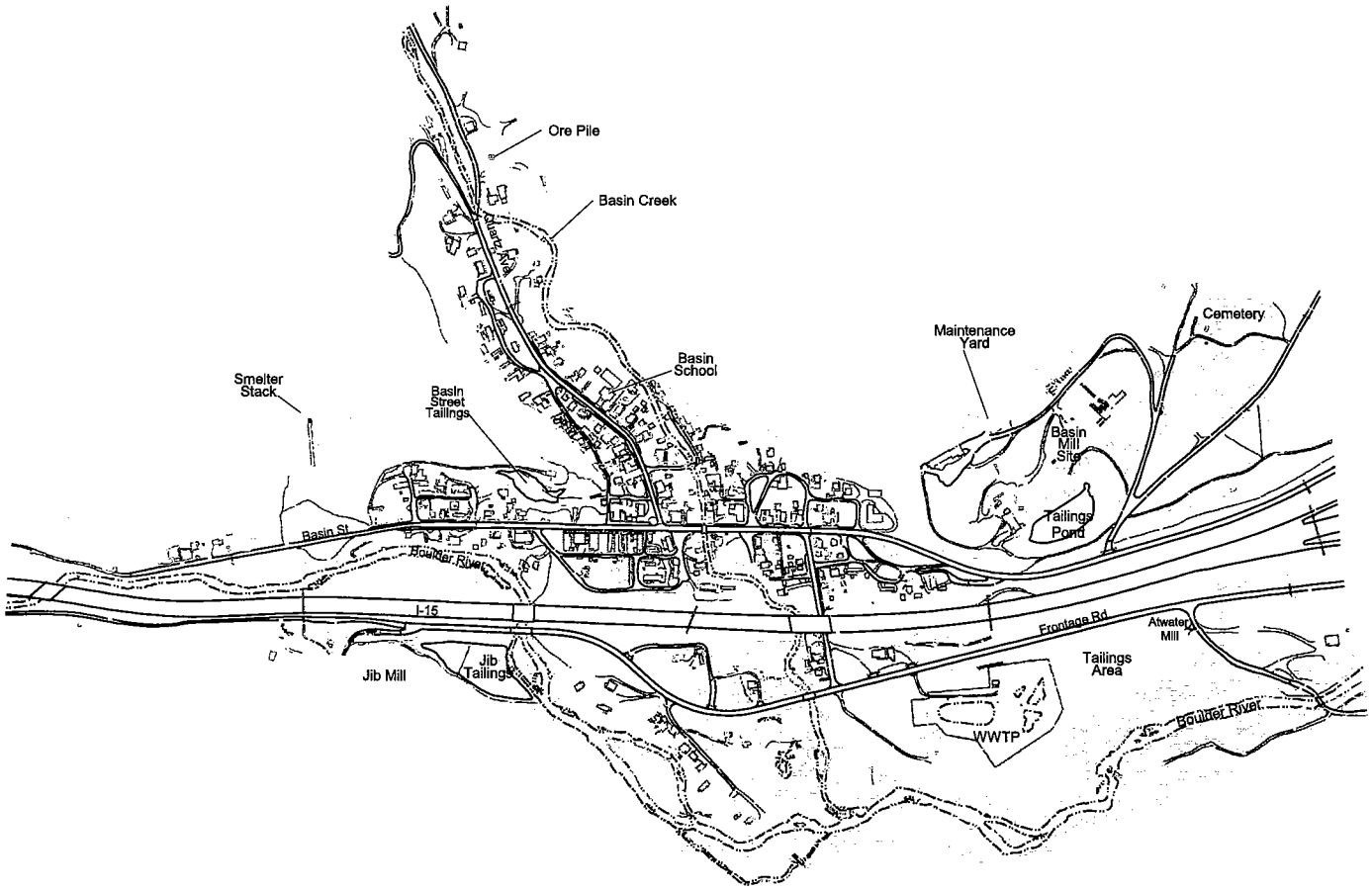


Town of Basin **Basin, Montana**	**Site Location Map**	**Figure No.** **2**
CDM Federal Programs Corporation *A subsidiary of Camp Dresser & McKee Inc.*		**3/01**



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Town of Basin Basin, Montana CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Site Map	Figure No. 3 3/01

Section 2
Operable Unit History and Enforcement Activities

Hard rock mining in the Basin Mining Area Superfund Site began in the 1870s and continued intermittently into the late 1950s. Extensive mining and milling within the Basin Mining Area have resulted in uncontrolled releases of metal contaminants from waste rock and tailings (waste material from processing of mineral ore) and have contaminated water to local streams.

Primary sources of contamination consist of numerous scattered mine waste rock piles and tailings piles resulting from historical mining and ore processing in the town of Basin in the late 1800s and early 1900s. Historical mining activities upstream of the town are also a source of contamination due to discharges to Basin Creek, which passes directly through town, or to the Boulder River on the south edge of town. Releases from these sources have resulted in contamination of soil, surface water, sediment, groundwater, air, and biota. Evidence of these releases includes elevated concentrations of contaminants in soil, surface water, and sediment; visual staining of stream sediments; observed mine wastes on stream banks; and noticeable erosion of wastes away from source piles.

The Basin Mining Area Site was placed on the National Priorities List (NPL) in October 1999. The following list summarizes the results of the investigations conducted in support of the listing and are part of the Administrative Record for the Town of Basin OU1.

The major investigations and activities conducted at the Town of Basin OU1 since 1980 include:

May 1980: Timberline Reclamations, Inc. prepared an environmental analysis on the mill tailings dispersal in Basin along the Boulder River for the Montana Highway Department.

September 1989: The Montana Department of Health and Environmental Sciences (MDHES, now DEQ) prepared a Preliminary Assessment (PA) for the site. Based on the findings of the PA, a Screening Site Inspection (SSI) was performed to characterize waste sources in and around the town of Basin.

January 1990: EPA collected surface soil samples from the Basin School yard, two fields near the school yard, houses near the school yard, and areas outside of the town.

April 1990: MDHES collected surface soil samples from the southwest corner of the Basin School yard.

June 1990: MDHES collected subsurface soil samples from eight of the previous sample locations in the southwest school yard. MDHES recommended that the Basin School Board take preventive actions to limit exposure to children. Oral communication with a representative of the School Board revealed that clean fill was placed over the southwest corner of the school yard.

August 1991: EPA completed an Expanded Site Inspection (ESI) to develop additional data for site characterization.

1993: Montana Department of State Lands Abandoned Mine Reclamation Bureau (MDSL AMRB) conducted a PA for the Basin Mill site.

1995: EPA completed data evaluation and prepared the site scoring package for placement of the Site on the NPL.

1998: EPA conducted a Removal Action in an area at the south end of Valley Street. Approximately 5,000 cubic yards (cy) of contaminated soil/ tailings were excavated and disposed at the mine waste repository in Butte, Montana. The excavated areas were backfilled with clean soil, graded, fertilized, seeded, and mulched.

Summer 1999: EPA collected soil samples throughout the town of Basin. Both surface (0-6 inches) and subsurface (12 inches) soil samples were collected.

October 1999: The Basin Mining Area Site was placed on the NPL.

April to July 2000: EPA conducted a field investigation at the Town of Basin OU1 to collect data from areas that were not sampled during previous investigations and to collect additional samples where historical data were questionable. EPA collected and analyzed surface soil samples and groundwater samples, and excavated five test pits in the area east of the Wastewater Treatment Plant (WWTP) to determine the depth of the mining waste material and if there was direct contact between the mining waste material and groundwater.

October 2000: EPA completed the Final Human Health and Risk Assessment (HHRA) Report and the Final Remedial Investigation (RI) Report for OU1.

December 2000: EPA completed the Final Feasibility Study (FS) Report for OU1.

January 2001: The Proposed Plan was issued for public comment.

EPA completed a search for potentially responsible parties (PRPs) and determined that no viable parties exist that caused the contamination at OU1. One general notice letter was issued to OT Mining, the current owner of the Basin Mill Site. The response from OT Mining to the general notice letter has indicated that they have applied to renew their groundwater permit issued by the State of Montana. The State of Montana is currently reviewing their application.

Section 3
Highlights of Community Participation

Public participation in the remedy selection process is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sections 113 and 117 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Section 300.430(f)(3). These sections require that before adoption of any plan for remedial action to be undertaken by EPA, the State, or an individual (e. g., PRP), the lead agency shall:

1. Publish a notice and make the Proposed Plan available to the public, and

2. Provide a reasonable opportunity for submission of written and oral comments and an opportunity for a public meeting at or near the site regarding the Proposed Plan and any proposed findings relating to cleanup standards. The lead agency shall keep a transcript of the meeting and make such transcript available to the public. The notice and analysis published under item 1 above shall include sufficient information to provide a reasonable explanation of the Proposed Plan and alternative proposals considered.

Additionally, notice of the final remedial action plan set forth in the ROD must be published, and the plan must be made available to the public before commencing any remedial action. Such a final plan must be accompanied by a discussion of any significant changes to the preferred remedy presented in the Proposed Plan along with the reasons for the changes. A response (Responsiveness Summary) to each of the significant comments, criticisms, and new data submitted in written or oral presentations during the public comment period must be included with the ROD.

In 1999, EPA held two meetings to determine the community needs and expectations with respect to cleanup activities.

In March 2000, EPA conducted interviews with the community and prepared a Community Relations Plan. Throughout the RI/ FS process, EPA prepared and distributed four fact sheets in March 2000, July 2000, August 2000, and October 2000. In addition, public meetings were held in January 2000, April 2000, August 2000, and October 2000 to discuss the project progress.

EPA has conducted the required community participation activities through the presentation of the RI, FS, and the Proposed Plan, a 30- day public comment period, a formal public hearing, and the presentation of the Selected Remedy in this ROD. EPA’s response to written comments received during the public comment period is included in the Responsiveness Summary, which is part of this ROD, and is designated Appendix A.

The Proposed Plan for OU1 was released for public comment on January 2, 2001. The RI, FS, and the Proposed Plan were made available to the public in the Administrative Record located at the EPA Montana Office in Helena, the Boulder Community Library in Boulder, and on the Town of Basin web site (www.basinou1.com). A formal public comment period was designated from January 2, through February 2, 2001.

On January 23, 2001, the EPA hosted a public meeting to present the Proposed Plan for the OU1 site of the Basin Mining Area Superfund Site. The meeting was held at 7:00 p.m. in the Basin School in Basin, Montana. Representatives from EPA presented a discussion on the RI, the HHRA, and the Proposed Plan, which discussed the following five alternatives:

- Alternative 1: No Action

- Alternative 2: Containment (Surface Water Control, Source Surface Control)/Removal/ Institutional and Non-Engineering Controls

- Alternative 3: Removal/Transportation/Disposal(Onsite Repository)/Institutional

Controls

- Alternative 4: Removal/Transportation/Disposal(Luttrell Repository)/Institutional Controls

- Alternative 5: Removal/Transportation/Disposal(Subtitle D Landfill)/Institutional Controls

Alternative 4, Removal/Transportation/Disposal(Luttrell Repository)/Institutional Controls was presented as EPA’s preferred alternative. A portion of the public meeting was dedicated to answering questions and accepting formal oral comments from the public. Community acceptance of the Selected Remedy is discussed in Section 10, Summary of Comparative Analysis of Alternatives, of this Decision Summary.

EPA’s responses to the comments received during the public comment period are included in the Responsiveness Summary which is part of this ROD.

Section 4
Scope and Role of Operable Unit

The Basin Mining Area Superfund Site covers a wide geographical area. As with many Superfund sites, the problems at the Basin Mining Area Superfund Site are complex. As a result, EPA established the following OUs to address the human health risks associated with mine waste located in the immediate vicinity of the Bas in community. The OUs are designated as:

OU1	Town of Basin
OU2	Basin Watershed

The selected remedy for OU2 will be covered in a separate ROD and will address contaminant sources, including those upstream on Basin Creek and Boulder River, that are not addressed in OU1.

The selected remedy for OU1, the subject of this ROD, addresses the potential direct exposure of the population to elevated concentrations of hazardous substances, pollutants, and contaminants in the residential soil and mine waste by removal and placement of these source materials in an offsite repository. Inhalation of airborne contamination or ingestion of contaminated soil, mine waste, sediment, dust, or surface water from this OU poses a current and potential risk because EPA’s acceptable risk range is exceeded. The selected remedy for this OU controls both erosion and airborne transport of contaminants. Removal of contaminated material also reduces leaching and migration of contaminants from mine waste into groundwater and erosion of contaminants into surface water. While the removal of waste material could cause a short-term exposure to airborne contamination during excavation and transportation, this exposure risk will be reduced by dust control measures implemented during the actual construction of the Selected Remedy. The institutional controls component of this alternative (zoning, proprietary controls, information, and educational programs) will control direct exposure to inaccessible contaminants if risks associated with such mine waste are identified.

Section 5
Summary of Site Characteristics

The Town of Basin OU1 consists of contaminated residential soils, a former smelter, streamside tailings, several tailings pile areas spread around the town, and a mill site as shown in Figure 3.

The Jib Mill/Hope-Katie Mine complex is located on the south side of the Boulder River immediately southwest of town. This waste source area was originally used as an ore extraction site and a small milling operation. Remnants of former structures remain in this area. A large tailings pile is present in this area. This tailings pile has been sprayed with a cohesive material to prevent erosional transport of the tailings material.

The Basin Street Tailings source is located in the west portion of town on the north side of the Boulder River. This waste source area, visible from I-15, contains a mine, with a headframe structure that collapsed in 1999, and associated tailings/waste rock.

A smelter stack flue is located on a steep hill on the west edge of town north of I-15. The smelter stack has visibly poor structural integrity. It has been reported that the smelter stack was never used for any mining operations. However, samples previously collected from inside the stack indicated elevated concentrations of metals. Access to the stack flue is not restricted. Samples collected during the RI eliminated the flue as a waste source.

The Basin Mill site is located immediately east of town. This potential waste source area consists of tailings piles, waste rock piles, a tailings pond, and a small number of buildings. Tailings were processed in this mill using a flotation process.

The WWTP is located south of I-15, east of Basin Creek. This facility was constructed in a former tailings pond. Tailings are widespread in the adjacent area east of the WWTP.

The Atwater Mill reportedly stood immediately west of the access road to the Merry Widow Mine, and the tailings pond lay roughly west of that access road. The exact location of the mill ruins cannot be identified from historical research or existing remains. This mill operated in the early 1900s and reworked the tailings from the Katie/Jib Mill.

5.1 Data Sources

During the PA/SSI (E&E 1989) eight surface soil, six surface water, six sediment, and four groundwater samples were collected. Results of the SSI showed elevated concentrations of several hazardous metal constituents and arsenic in tailings piles and in the surface soil of the Basin School yard.

In 1990, EPA collected surface soil samples from the school yard, from two fields near the school yard, from several houses near the school yard and from two background locations (E&E 1990). The concentrations of arsenic in these soils samples were less than those collected in 1989. However, the report noted that the southwest corner of the school yard appeared to have higher concentrations of arsenic.

In April 1990, MDHES conducted surface soil sampling primarily in the southwest corner of the Basin School yard. The 20 samples collected for this effort were analyzed for arsenic only. The data collected from this effort indicated that high concentrations of arsenic were limited to the southwest quadrant (MDHES 1990a).

In June 1990, MDHES collected 13 subsurface soil samples (6 to 18 inches below ground surface [bgs]) from eight of the previous sample locations in the southwest corner of the school yard. These samples were also analyzed for arsenic. The sample results confirmed the findings of the April 1990 surface soil samples in that the highest concentrations of arsenic were restricted to the western portion of the southwest quadrant (MDHES 1990b).

An ESI was completed in August 1991 to provide additional Hazard Ranking System (HRS) data for site characterization (E&E 1991). Seventeen surface soil samples, one waste source sample, one surface water sample, and one sediment sample were collected. The team collected samples from residential yards and screened the samples using X-ray fluorescence (XRF). If the screening results indicated elevated contaminant levels, the samples were sent to a laboratory for further analysis. This study revealed elevated levels of arsenic and several heavy metal contaminants in soil samples. The investigation also documented the presence of seven waste sources in and around the town of Basin: the smelter stack area, the Basin Street Tailings, the Jib Tailings, the Basin Mill site, the Basin School yard, the Basin WWTP Tailings, and residential soils.

In 1993, MDSL AMRB completed a PA for the Basin Mill site (MDSL AMRB 1993). For the PA, nine samples were collected from waste rock piles. Seven waste rock piles were sampled individually, and two composite samples of the piles were also collected. Eleven samples were collected from the tailings pond from three selected locations. Nine samples were collected from various depth intervals at these locations. In addition, two composites samples were collected from the tailings pond. Arsenic and lead contamination was identified in the waste piles and the tailings pond.

EPA completed a Time-Critical Removal Action in 1998 in an area located at the south end of Valley Street in the town of Basin. A sample collected from the area during the ESI contained arsenic at a concentration of 412 milligrams per kilogram (mg/kg). In October 1997, EPA collected additional samples from this tailings area. The analytical results from these samples indicated concentrations of up to 1,500 mg/kg arsenic, 2,600 mg/kg copper, 580 mg/kg lead, and 940 mg/kg zinc (URS Operating Service [UOS] 1999).

In the summer of 1999, EPA completed an extensive XRF survey throughout the town of Basin. A total of 551 soil samples were collected from residential yards and analyzed for lead and arsenic. During this survey, both surface (0-6 inches) and subsurface (12 inches) soil samples were collected. A percentage of the samples collected were submitted to a laboratory for confirmation analysis. The confirmation samples were analyzed for arsenic and lead by EPA SW-846 Method 6010B. The draft Sampling Activities Report was completed on January 7, 2000, and it is still under review (UOS 2000).

EPA completed an RI for the Town of Basin OU1 in April through June 2000. The objective of the RI was to determine which of the potential source areas should be considered for remediation. The purpose of the RI was to collect data from areas within OU1 that were not sampled during previous investigations and to collect additional samples where historical data were questionable. Surface soil samples and groundwater samples were collected and analyzed. Five test pits were excavated in the area east of the WWTP to determine the depth of mine waste and whether there was direct contact between mine waste and groundwater. The results of the RI were published in the Final Remedial Investigation Report submitted in October 2000 (CDM Federal 2000b).

5.2 Site Conceptual Exposure Model

As shown in the site conceptual exposure model (SCEM) (Figure 4), contaminants may be released from mine waste rock piles and tailings piles through surface water runoff, wind erosion, infiltration/leaching to groundwater, biotic uptake, human activity, and/or application (dumping) directly onto soils. Adits may discharge contaminants to soils and surface water; contaminants may also leach to groundwater. These releases may result in contamination of primary media: air, surface and subsurface soil, surface water, and groundwater.

Mechanisms of release from these primary media also exist. Contaminants in surface water may be released to sediments (through deposition and sorption), biota (through uptake), and groundwater (through infiltration). Contaminants in soil may be released to biota (through uptake), groundwater (through leaching), surface water (through runoff), air (through erosion), and interior dust (through human activities). Contaminants in air may be released to soil and surface water through wet or dry deposition. Contaminants in

groundwater may discharge to surface water, and contaminants in sediment may be released to surface water (through desorption/sorption) and biota (through uptake). Cycling of contaminants among site media will also occur. For example, metals may partition between surface water and sediments and migrate between surface water and groundwater in gaining and losing stream reaches.

5.3 Source Material Descriptions

Primary sources of contamination consist of numerous scattered mine waste rock piles and tailings piles resulting from historical mining and ore processing in the town of Basin in the late 1800s and early 1900s (EPA 1999b). Historical mining activities upstream of the town are also a source of contamination due to discharges to Basin Creek which passes directly through town to the Boulder River, on the south edge of town. Releases from these sources have resulted in contamination of soil, surface water, sediment, groundwater, air, and biota. Evidence of these releases includes elevated concentrations of contaminants in soil, surface water, and sediment, visual staining of stream sediments, observed mine wastes on stream banks, and noticeable erosion of wastes away from source piles. This section summarizes data obtained through previous investigations to describe the characteristics of these materials and their spatial distribution.

5.3.1 Soil and Source Material Characteristics

To determine the nature and extent of soil contamination for the Town of Basin OU1, EPA used the analytical results for soil samples collected and/ or analyzed during 1999 and 2000, as well as data collected in previous investigations. In instances where both laboratory data and XRF data were collected from the same location, EPA used the laboratory data to determine the nature and extent of contamination. Based on the samples used for the evaluation, soil is contaminated with lead, arsenic, and manganese at depths up to 12 inches bgs within the residential areas and at deeper intervals within mine waste areas. Figures 5 through 9 depict the soil concentrations in surface and subsurface soil for arsenic, lead and manganese. Arsenic and lead were determined to be the primary contaminants throughout the site; therefore, the discussion on transport and fate focused on lead and arsenic.

5.3.2 Material Volume Estimates

The Cleanup Levels described in Section 3.3 of the Final Feasibility Study Report (CDM Federal 2000a) and Section 7 herein were used to estimate the volume of contaminated residential soil and mine waste. The areas where residential soil or mine waste material exceeded the Cleanup Levels are shown on Figure 10. Areas and the corresponding volumes for mine waste and residential soils that were evaluated under each remedial action alternative are presented in Tables 1 and 2, respectively. Discussions of waste areas and waste volume determinations are presented below.

> ***Note:*** *The Selected Remedy was modified to include removal of all contaminated material, which would cause an increase of 3,800 cy from the WWTP tailings. However, due to the possible reclamation actions by the mill operator, volume estimates for the Basin Mill site were removed from the remedial action, decreasing the total estimated volume by 10,210 cy. Refer to Section 12 for a discussion of the changes made after the FS was completed.*

5.3.2.1 Jib Tailings

The Jib Tailings site is adjacent to the Boulder River and will continue to contribute contaminants to the surface water unless the entire source area is remediated. For the waste volume in Table 1, the source area is assumed to be 5 feet deep.

5.3.2.2 Streamside Tailings

Several source areas, streamside tailings, are located along the Boulder River (T-4, T-5, T-6, T-7, T-8, and T-10). As in the case of the Jib Tailing s, these source areas will continue to contribute contaminants to the surface water. It is assumed that each area was 2 feet deep.

5.3.2.3 Basin Street Tailings

This source area is located within the town. All of the contaminated soil will be removed from this area. It is assumed that the contaminated soil is 2 feet deep.

5.3.2.4 Mine Waste Areas

For the remaining mine waste areas not previously discussed, it was assumed in the FS that the upper 2 feet of contaminated material will be remediated. For areas that contain waste piles above ground surface, topographic maps were used in conjunction with the surface areas to calculate volumes for each waste pile. In addition, it is assumed that an additional 2 feet of soil beneath the piles will require removal.

> ***Note:*** *The Selected Remedy was modified to include removal of all contaminated material. Refer to Section 12 for a discussion of the Selected Remedy.*

5.3.2.5 Residential Soils/Basin School Yard

For the waste volumes in Table 2, it was assumed that 2 feet of contaminated material exist over the entire residential property. This depth was determined to be a conservative estimate since most of the samples collected at depths up to 1-foot bgs were not contaminated at concentrations near the Cleanup Level. Based on the RI, approximately 27 residential yards in the Town of Basin OU1 will require remediation (CDM Federal 2000b).

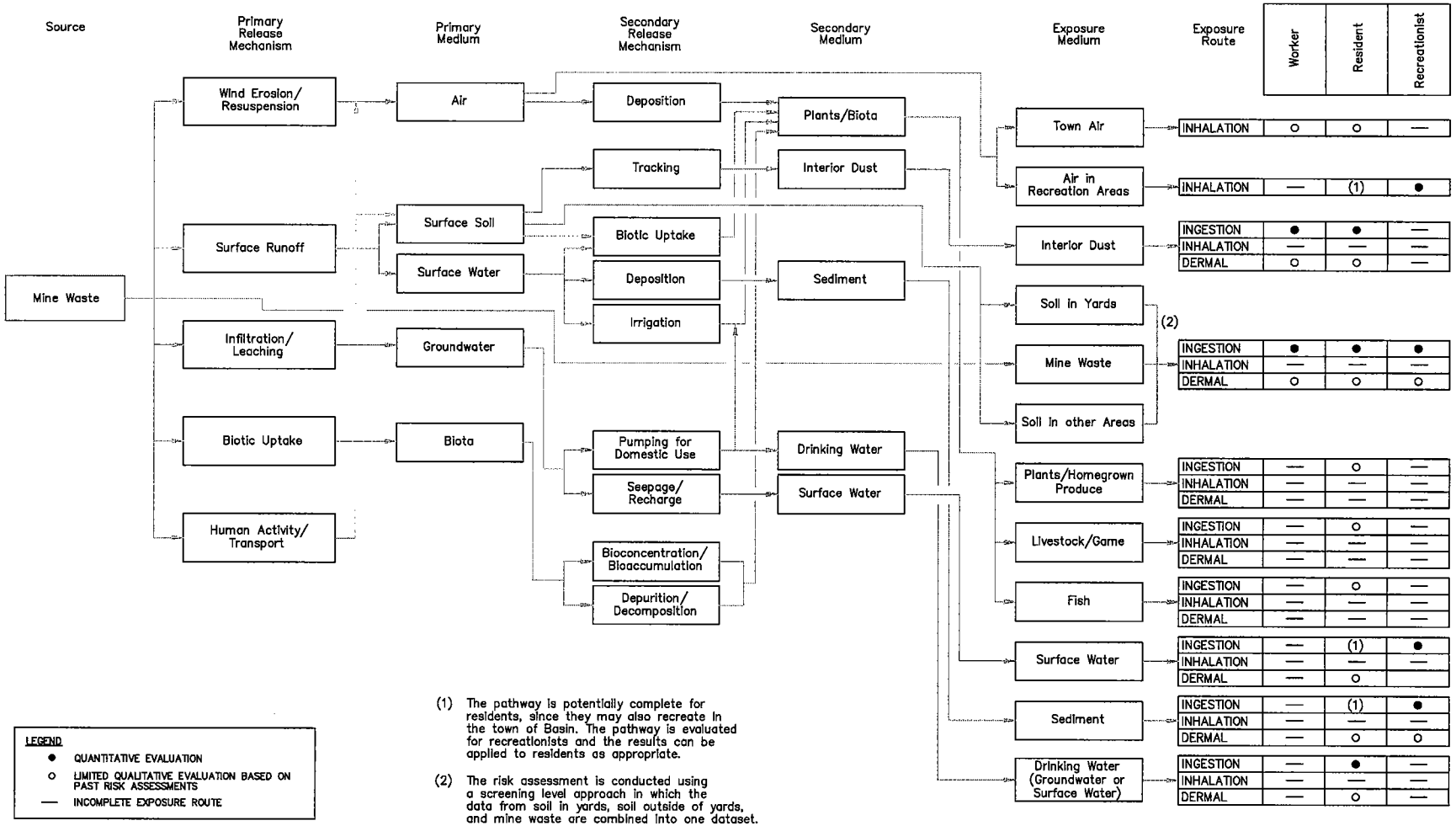
The volume of waste to be remediated in the Basin School yard assumes the southwest area of the school yard will require remediation. The residential yards and the Basin School yard comprise the total residential soil volume presented in Table 2.

5.4 Groundwater Quality

EPA sampled 10 wells throughout the town of Basin in 2000. Another eight wells were sampled during previous investigations. Analytes were not detected above the current federal and/or state drinking water standards listed in Appendix B in any of the drinking water wells. The groundwater sample collected from monitoring well MW-2 at the Basin Mill site contained lead at a concentration of 16.5 micrograms per liter (µg/L), slightly above the standard of 15 µg/L. This well is located adjacent to the tailings pond which is likely the source of the elevated lead level. Because contamination has not been documented in drinking water wells, this ROD will not address groundwater.

5.5 Surface Water Quality

Surface water and sediment sampling has been conducted along the Boulder River and Basin Creek. These media, along with instream tailings, will be evaluated during the RI for the Basin Watershed OU2 and will be addressed in the FS and the Proposed Plan for OU2. However, tailings along the bank of the Boulder River will be removed to the extent practical. Any recontamination of the streamside areas in OU1 which result from releases in OU2 will be remediated in the OU2 action.



(1) The pathway is potentially complete for residents, since they may also recreate in the town of Basin. The pathway is evaluated for recreationists and the results can be applied to residents as appropriate.

(2) The risk assessment is conducted using a screening level approach in which the data from soil in yards, soil outside of yards, and mine waste are combined into one dataset.

Town of Basin OU1 Basin, Montana CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Site Conceptual Exposure Model for Human Health Risk Assessment Town of Basin	Figure No. 4 3/01

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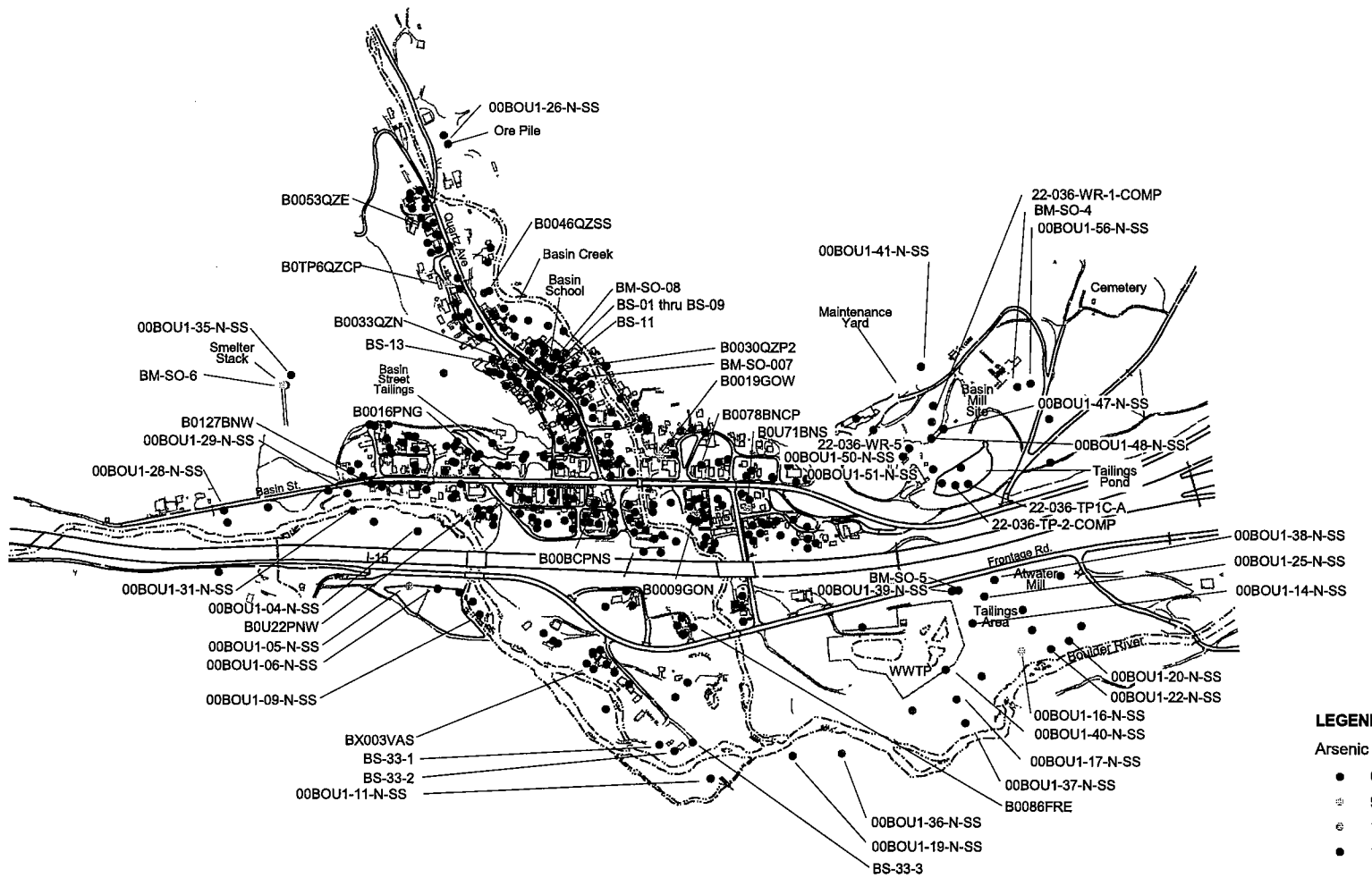

Town of Basin Basin, Montana CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Surface Soils with Arsenic (0-6" depth)	Figure No. 5 3/01

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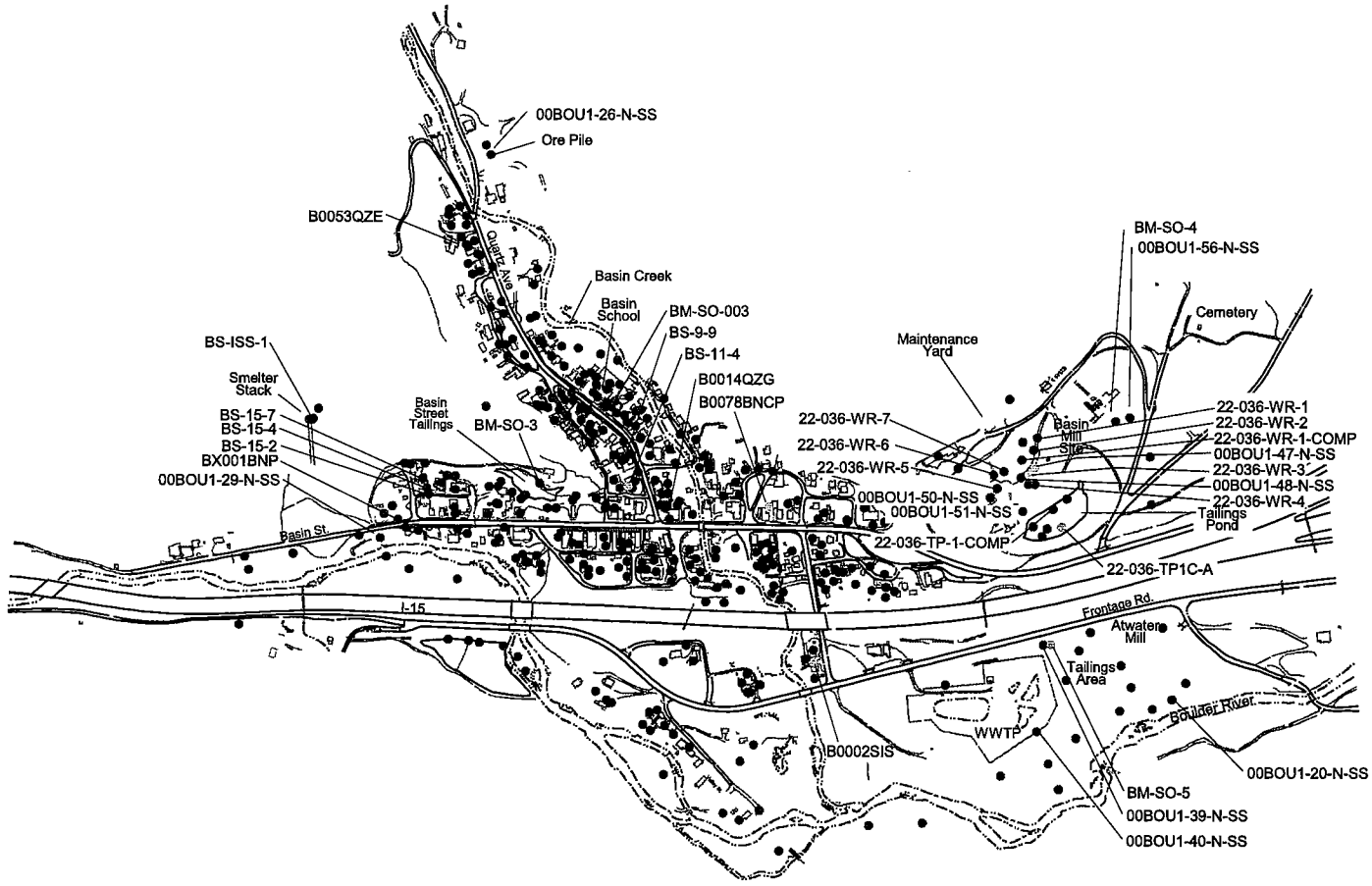
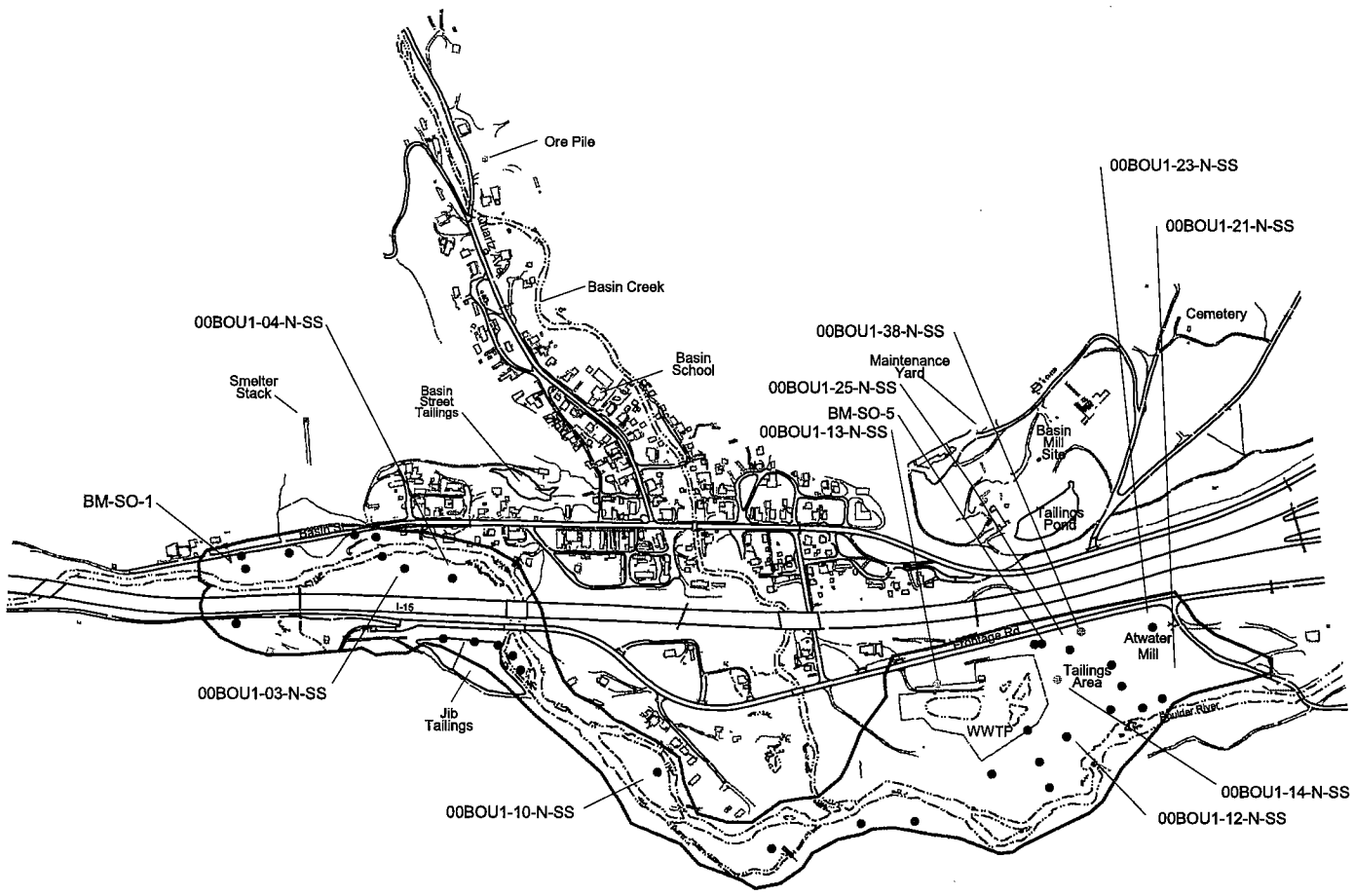


Town of Basin Basin, Montana	Surface Soils with Lead (0-6" depth)	Figure No. 6
CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.		3/01

Basin UTM.apr; View 02 - Soils



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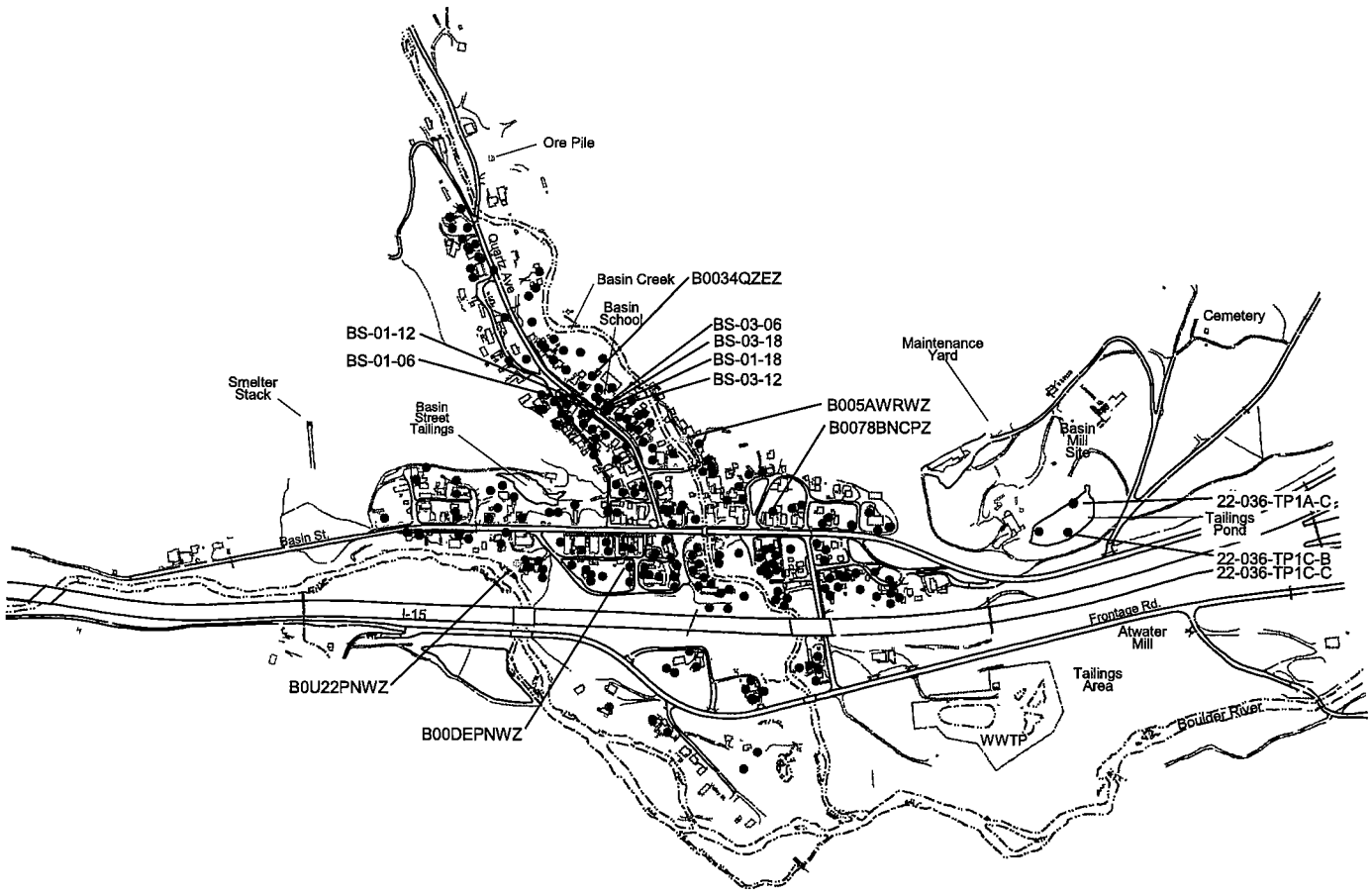
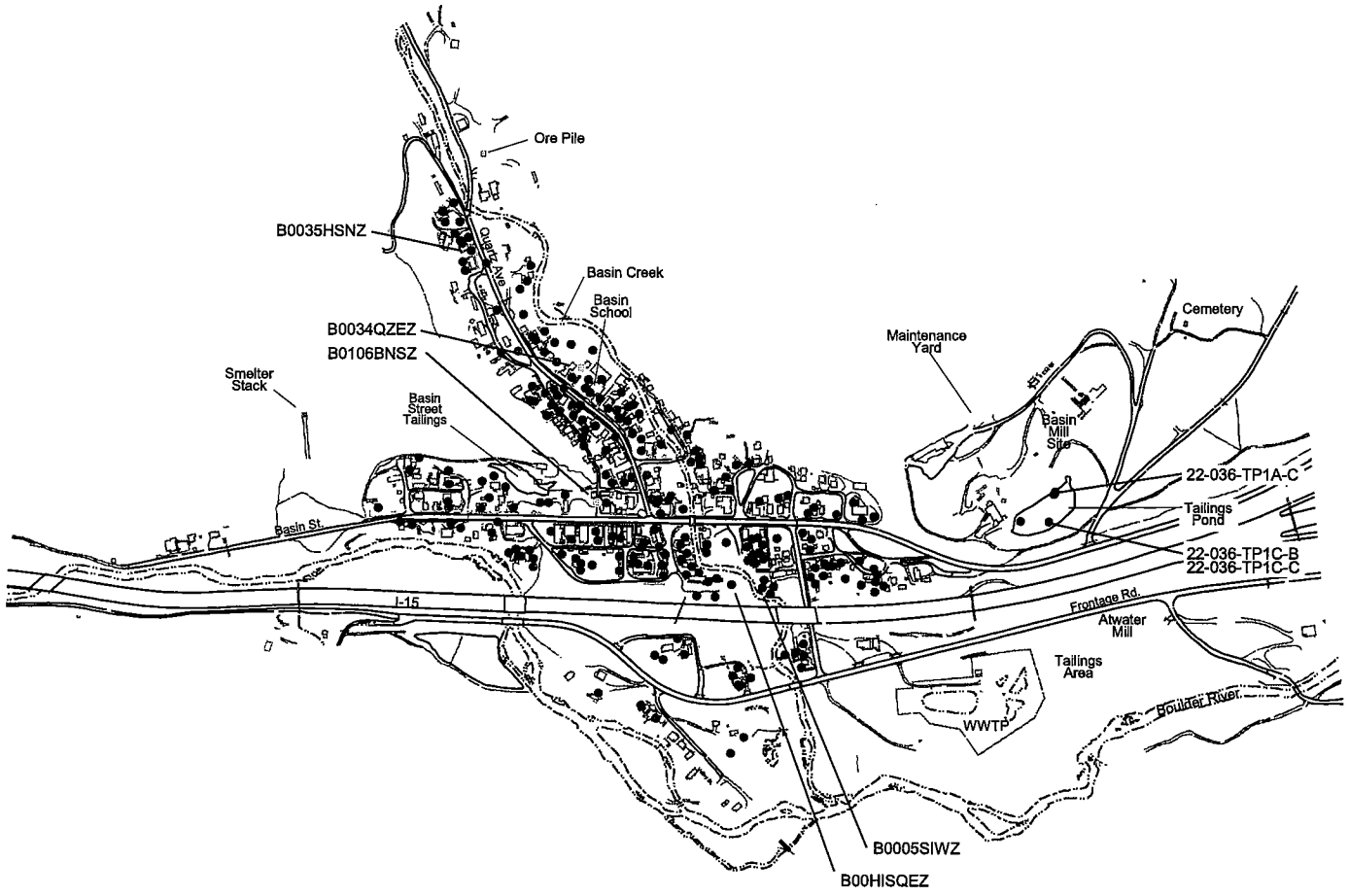
Town of Basin Basin, Montana CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.	Recreational Areas with Surface Soil Manganese (0-6" depth)	Figure No. 7 3/01



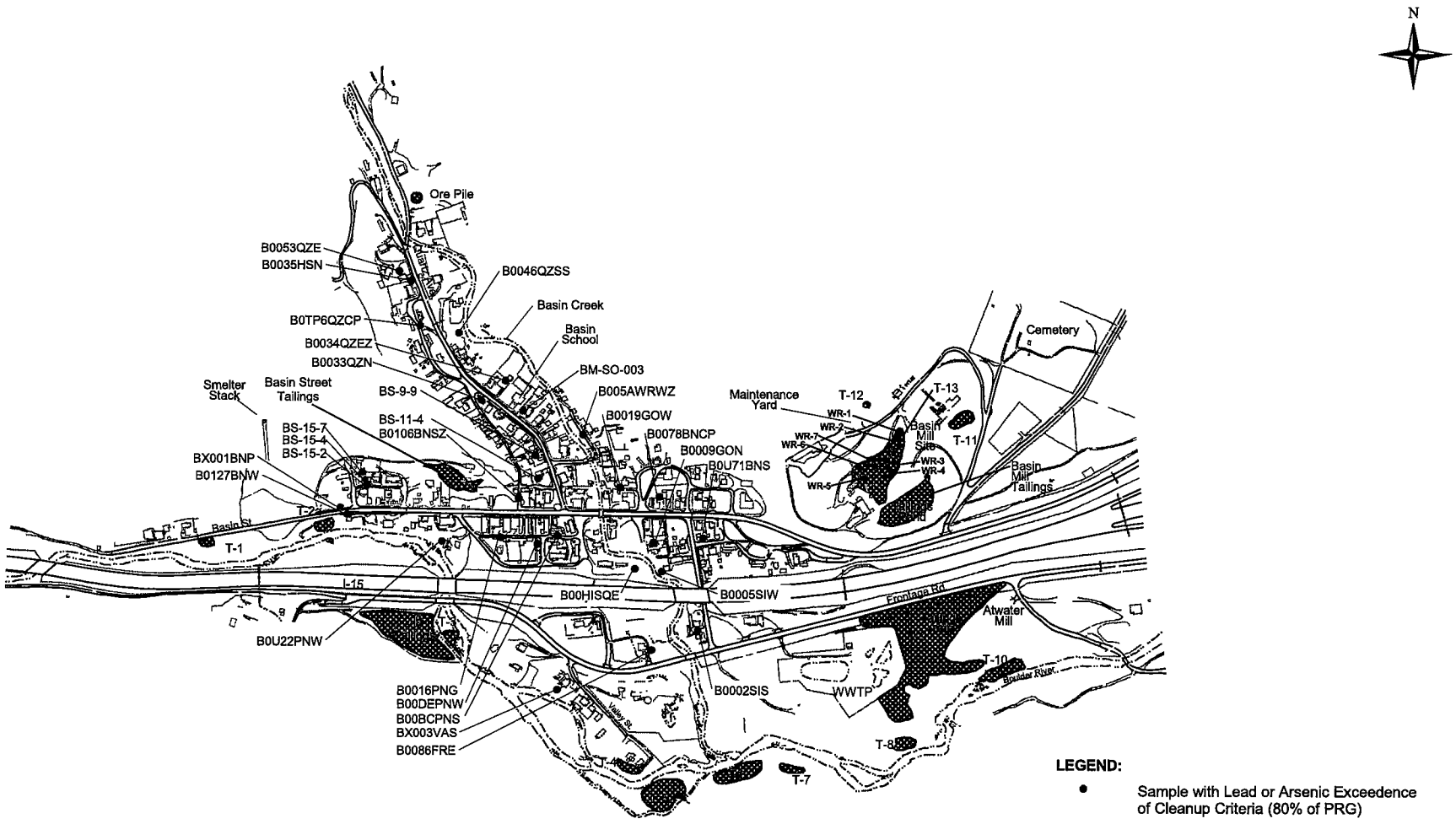
Town of Basin Basin, Montana	Subsurface Soils with Arsenic (> 6" depth)	Figure No. 8
CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.		3/01

Basin UTM.apr; View -02- Soils



Town of Basin Basin, Montana	Subsurface Soils with Lead (> 6" depth)	Figure No. 9
CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.		3/01

Basin UTM.apr: View 02 - Soils



Town of Basin Basin, Montana	Potential Waste Areas	Figure No. 10
CDM Federal Programs Corporation A subsidiary of Camp Dresser & McKee Inc.		3/01

Basin UTM.apr; View -08 Potential Exceedances

Table 1
Waste Areas and Volumes for Mine Waste*

Location	*Designation*	*Area (sy)*	*In-Place Volume (bcy)*
Basin Mill Site			
Tailings Pond	TP-1	5,321	3,565
Pile	WR-1	87	68
Pile	WR-2	370	287
Pile	WR-3	239	293
Pile	WR-4	194	216
Pile	WR-5	43	38
Pile	WR-6	183	142
Pile	WR-7	89	99
East of Mill Site	T-11	1,018	682
Area Around Site	T-13	7,194	4,820
Subtotal		13,248	10,210
Maintenance Yard			
Near Basin Mill Site	T-12	114	76
Basin Street Tailings			
Near Basin Street	NA	2,412	1,616
Ore Pile			
North End of Town	NA	310	448
Jib Tailings			
Jib Tailings	NA	8,880	14,800
WWTP Tailings			
WWTP	T-9	26,319	17,634
Tailings Adjacent to Boulder River			
Pile	T-1	376	252
Pile	T-2a	682	457
Pile	T-2b	77	52
Pile	T-3	591	396
Pile	T-4	876	587
Pile	T-5	3,793	2,541
Pile	T-6	2,432	1,629
Pile	T-7	596	399
Pile	T-8	830	556
Pile	T-10	1,738	1,164
Subtotal		11,991	8,033
TOTAL		64,764	52,817

Notes

(1) Locations WR-1 through WR-7 at the Basin Mill site and the Ore Pile north of town are waste piles that exist above ground surface. In-place volume calculations for these waste areas are not directly correlatable to the surface areas.

(2) The volume for the Jib Tailings was calculated by multiplying area by 1.67 yards (approximately 5 feet) to obtain in-place volume in bank cubic yards (bcy). Volumes for all other locations were calculated by multiplying area by 0.67 yards (approximately 2 feet) to obtain in-place volume in bcy.

(3) Areas with arsenic and lead concentrations greater than 80 percent of the Preliminary Remediation Goals (PRGs) are included in this table.

* The Selected Remedy was modified to include removal of all contaminated material. In addition, the Basin Mill site was removed from the remedial action. Refer to Section 12 for a discussion of the changes.

Table 2
Waste Areas and Volumes for Residential Soils

Location	*No. of Lots*	*In-Place Volume (bcy)*
Basin School Yard	1	239
Residences	27	7,172
TOTAL		7,411

Notes

(1) Volumes were calculated assuming that a minimum of 2 feet (0.67 yards) of soil would be remediated in those areas with arsenic and/or lead concentrations within 80 percent of the PRG.

Section 6
Current and Potential Future Land Use

Both current and future land use are evaluated in the selection of potential human receptors (EPA 1991). For example, areas where residential development could occur are considered residential in the future and evaluated accordingly.

Residential, commercial, and recreational activities occur in the town of Basin. Residents that engage in recreational activities may be the most important category of human receptors for the site. These individuals may live in areas impacted by mining wastes and may also recreate near their homes in other contaminated areas. Non-residents may also be exposed, and exposures for such individuals may be important for risk management decisions for the site. Therefore, non-resident recreationists and commercial workers are also receptors of concern.

Human populations of potential concern therefore consist of residents, recreational users of the site, and workers (e. g., people involved in mining, including reclamation and/or remediation). Residents living in areas impacted by mining wastes who also engage in recreational activities within the site are presumed to have the most exposure.

Section 7
Summary of Site Risks

EPA developed a preliminary list of 10 chemicals of potential concern (COPCs) which represent mining-related contaminants that could be of concern for human health threats for the site. The COPCs are: antimony, arsenic, cadmium, copper, iron, lead, manganese, mercury, thallium, and zinc. Three of these chemicals, arsenic, lead, and manganese, were detected at elevated concentrations in the soil in the town of Basin. There is a correlation between elevated arsenic and lead levels and the other metal COPCs. Based upon these assumptions, arsenic and lead were used as indicators of elevated contaminant concentrations in residential soils and mine waste.

It is EPA’s and DEQ’s current judgement that the Selected Remedy, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

7.1 Human Health Risks

The following HHRA is pertinent to OU1:

- CDM Federal. 2000c. *Final Human Health Risk Assessment Report for Basin Mining Area Superfund Site Town of Basin Operable Unit 1 (OU1) Jefferson County, Montana*. October.

The following steps were taken to determine how residents may be exposed to contaminants:

First, EPA identified both current and future potential human receptors on and near the site. These populations consist of residents, recreational users of the site, and workers (e.g., people involved in mining, including reclamation and/or remediation). Residents who live in areas affected by mining wastes and who engage in recreational activities within the site were presumed to have the most exposure.

EPA also evaluated sub- populations of concern, or groups of people who might be at increased risk for detrimental effects from chemical exposures. For the town of Basin, children who also engage in recreational activities on- site were considered to be a sub-population.

Next, EPA identified the pathways by which these human populations might be exposed to site-related chemicals. For residents and workers, inhalation and ingestion were the exposure pathways of concern. Ingestion was the exposure pathway of concern for recreationists.

EPA then estimated exposure point concentrations and calculated chemical intake. Exposure point concentrations are estimated chemical concentrations a receptor will contact over an exposure period. The amount of chemical that is taken into a person's body following exposure is referred to as “chemical intake.”

The following sections summarize the results of this HHRA, including media and contaminants of concern (COCs), exposure assessment, and risk characterization, as they relate to OU1.

7.1.1 Media and Contaminants of Concern

In the data evaluation step of the HHRA, COPCs were selected using previously collected data for the site presented in Tables 3 through 7. COPCs for each medium are summarized in Table 8.

Table 8
Summary of Chemicals of Potential Concern
Town of Basin, Montana

Chemical	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
Antimony					
Arsenic					
Cadmium					
Copper					
Iron					
Lead					
Manganese					
Mercury					
Thallium					
Zinc					

7.1.2 Exposure Assessment

Exposure is defined as human contact with a chemical or physical agent (EPA 1989). Exposure assessment consists of three steps:

1. Characterization of Exposure Setting
2. Identification of Exposure Pathways for Human Receptors
3. Quantification of Exposure

The first step involves identifying physical characteristics of a site (i.e., climate) and the current and potential future human populations on and near the site. The second step of the exposure assessment identifies pathways by which human populations might be exposed to site-related chemicals.

The final step, exposure quantification, has two components: estimation of exposure point concentrations and calculation of chemical intake. Exposure point concentrations were estimated for COPCs for each medium using data from previous investigations.

Chemical intake is the amount of chemical contacted per unit of body weight per unit of time, and is calculated by combining pathway- specific exposure assumptions, such as frequency and duration of exposure, with exposure point concentrations. Pathway-specific exposure assumptions, and chemical intake calculations are presented in the exposure assessment section of the HHRA.

For the evaluation of human health risks, sites are usually segregated into exposure units. EPA guidance indicates that differences in land use, population characteristics,

TABLE 3
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE SOIL
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: Contact with soil

Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value*	COPC Flag	Rationale for Contaminant Deletion or Selection
Antimony	4.6	329	mg/kg	24 / 272	4.1 - 14.2	329	NA	31	YES	ASL
Arsenic	1.3	2,840	mg/kg	352 / 352	NA	2,840	NA	0.43	YES	ASL
Barium	40.4	2,020	mg/kg	272 / 272	NA	2,020	NA	5,500	NO	BSL
Cadmium	0.18	103	mg/kg	197 / 272	0.5 - 1.5	103	NA	78	YES	ASL
Copper	5.2	963	mg/kg	272 / 272	NA	963	NA	3,100	NO	BSL
Iron	3,370	200,000	mg/kg	272 / 272	NA	200,000	NA	23,000	YES	ASL
Lead	6.9	27,600	mg/kg	330 / 330	NA	27,600	NA	400	YES	ASL
Manganese	6.5	5,950	mg/kg	272 / 272	NA	5,950	NA	1,600	YES	ASL
Mercury	0.01	2.2	mg/kg	25 / 42	0.04 - 1.3	2.2	NA	NA	YES	NSL
Silver	0.63	24	mg/kg	70 / 267	0.56 - 7	24	NA	390	NO	BSL
Thallium	0.16	3.2	mg/kg	194 / 267	0.21 - 1	3.2	NA	5.5	NO	BSL
Uranium	9.2	14.5	mg/kg	14 / 230	50 - 50	14.5	NA	230	NO	BSL
Zinc	15.7	77,500	mg/kg	272 / 272	NA	77,500	NA	23,000	YES	ASL

*EPA Region III risk-based concentrations October 1999

mg/kg = milligrams per kilogram

NA = not available

ND = not detected

COPC = chemical of potential concern

ASL = maximum concentration above screening level

BSL = maximum concentration below screening level

NSL = no screening level; chemical is therefore retained as a COPC.

TABLE 4
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUBSURFACE SOIL
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Subsurface soil
Exposure Medium: Subsurface soil
Exposure Point: Contact with soil

Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value*	COPC Flag	Rationale for Contaminant Deletion or Selection
Antimony	4.7	9.4	mg/kg	13 / 208	6 - 6	9.4	NA	31	NO	BSL
Arsenic	1.1	750	mg/kg	253 / 253	NA	750	NA	0.43	YES	ASL
Barium	46	762	mg/kg	208 / 208	NA	762	NA	5,500	NO	BSL
Cadmium	0.21	11.4	mg/kg	108 / 208	0.5 - 0.5	11.4	NA	78	NO	BSL
Copper	2.9	540	mg/kg	208 / 208	NA	540	NA	3,100	NO	BSL
Iron	3,750	42,600	mg/kg	208 / 208	NA	42,600	NA	23,000	YES	ASL
Lead	4.1	3,000	mg/kg	238 / 238	NA	3,000	NA	400	YES	ASL
Manganese	59.4	1,380	mg/kg	208 / 208	NA	1,380	NA	1,600	NO	BSL
Silver	0.74	7.8	mg/kg	36 / 208	1 - 1	7.8	NA	390	NO	BSL
Thallium	0.16	2.8	mg/kg	171 / 208	1 - 1	2.8	NA	5.5	NO	BSL
Uranium	10	18.8	mg/kg	5 / 208	50 - 50	18.8	NA	230	NO	BSL
Zinc	16.9	35,200	mg/kg	208 / 208	NA	35,200	NA	23,000	YES	ASL

*EPA Region III risk-based concentrations October 1999

mg/kg = milligrams per kilogram

NA = not available

ND = not detected

COPC = chemical of potential concern

ASL = maximum concentration above screening level

BSL = maximum concentration below screening level

TABLE 5
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Contact with groundwater

Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value*	COPC Flag	Rationale for Contaminant Deletion or Selection
Antimony	0.0023	0.0023	mg/L	1 / 8	0.002 - 0.04	0.0023	NA	0.02	NO	BSL
Arsenic	0.00196	0.0034	mg/L	4 / 9	0.002 - 0.01	0.0034	NA	0.00005	YES	ASL
Barium	0.0243	0.0685	mg/L	7 / 8	0.025 - 0.03	0.0685	NA	3	NO	BSL
Cadmium	0.001	0.001	mg/L	1 / 9	0.0003 - 0.004	0.001	NA	0.02	NO	BSL
Chromium	ND	ND	mg/L	0 / 8	0.0004 - 0.009	0.009	NA	0.11	NO	BSL
Copper	0.0014	0.0911	mg/L	6 / 9	0.001 - 0.01	0.0911	NA	1.50	NO	BSL
Iron	0.0122	0.376	mg/L	7 / 8	0.011 - 0.01	0.376	NA	11	NO	BSL
Lead	0.0011	0.003	mg/L	2 / 9	0.001 - 0.01	0.003	NA	NA	YES	NSL
Manganese	0.0117	0.107	mg/L	2 / 8	0.001 - 0.004	0.107	NA	0.73	NO	BSL
Mercury	ND	ND	mg/L	0 / 8	0.0001 - 0.0002	0.0002	NA	NA	YES	NSL
Silver	ND	ND	mg/L	0 / 8	0.0003 - 0.01	0.01	NA	0.18	NO	BSL
Thallium	0.0018	0.0018	mg/L	2 / 8	0.002 - 0.004	0.0018	NA	0.003	NO	BSL
Zinc	0.0139	0.45	mg/L	9 / 9	NA	0.45	NA	11	NO	BSL

*EPA Region III risk-based concentrations October 1999

mg/L = milligrams per liter

NA = not available

ND = not detected

COPC = chemical of potential concern

ASL = maximum concentration above screening level

BSL = maximum concentration below screening level

NSL = no screening level; chemical is therefore retained as a chemical of potential concern.

TABLE 6
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE WATER
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Surface water
Exposure Medium: Surface water
Exposure Point: Contact with surface water

Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value*	COPC Flag	Rationale for Contaminant Deletion or Selection
Antimony	0.0524	0.0524	mg/L	1 / 9	0.0018 - 0.0625	0.0524	NA	0.015	YES	ASL
Arsenic	0.0031	0.0100	mg/L	8 / 9	0.0022 - 0.0022	0.01	NA	0.00005	YES	ASL
Barium	0.0243	0.133	mg/L	4 / 9	0.0254 - 0.0254	0.133	NA	2.6	NO	BSL
Cadmium	0.00049	0.237	mg/L	2 / 9	0.0020 - 0.0054	0.237	NA	0.018	YES	ASL
Chromium	0.00235	0.006	mg/L	3 / 9	0.0054 - 0.0138	0.0059	NA	0.11	NO	BSL
Copper	0.0106	12.6	mg/L	4 / 9	0.0040 - 0.0184	12.6	NA	1.5	YES	ASL
Iron	0.148	2.76	mg/L	8 / 9	0.0204 - 0.0204	2.76	NA	11	NO	BSL
Lead	0.001	1.42	mg/L	8 / 10	0.0009 - 0.0460	1.42	NA	NA	YES	NSL
Manganese	0.0299	8.39	mg/L	4 / 9	0.0034 - 0.0155	8.39	NA	0.730	YES	ASL
Mercury	ND	ND	mg/L	0 / 9	0.0001 - 0.0002	0.0002	NA	NA	YES	NSL
Silver	ND	ND	mg/L	0 / 9	0.0003 - 0.0056	0.0056	NA	0.180	NO	BSL
Thallium	ND	ND	mg/L	0 / 9	0.0010 - 0.0037	0.0037	NA	0.003	YES	ASL
Zinc	0.0178	5.02	mg/L	9 / 9	NA	5.02	NA	11	NO	BSL

*EPA Region III risk-based concentrations October 1999

mg/L = milligrams per liter

NA = not available

ND = not detected

COPC = chemical of potential concern

ASL = maximum concentration above screening level

BSL = maximum concentration below screening level

NSL = no screening level; chemical is therefore retained as a COPC.

TABLE 7
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEDIMENT
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Contact with sediment

Chemical	Minimum Detected Concentration	Maximum Detected Concentration	Units	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value*	COPC Flag	Rationale for Contaminant Deletion or Selection
Antimony	10.2	10.2	mg/kg	1 / 7	5.4 - 11.8	10.2	NA	31	NO	BSL
Arsenic	6.1	131	mg/kg	7 / 7	NA	131	NA	0.43	YES	ASL
Barium	112	538	mg/kg	7 / 7	NA	538	NA	5,500	NO	BSL
Cadmium	1.3	5.9	mg/kg	4 / 7	0.5 - 0.9	5.9	NA	78	NO	BSL
Chromium	9.4	19.6	mg/kg	6 / 7	7.7 - 7.7	19.6	NA	230	NO	BSL
Copper	14.9	447	mg/kg	7 / 7	NA	447	NA	3,100	NO	BSL
Iron	9,790	20,900	mg/kg	7 / 7	NA	20,900	NA	23,000	NO	BSL
Lead	8.6	1,300	mg/kg	7 / 7	NA	1,300	NA	400	YES	ASL
Manganese	140	1,240	mg/kg	7 / 7	NA	1,240	NA	1,600	NO	BSL
Mercury	0.14	0.21	mg/kg	2 / 7	0.1 - 0.17	0.21	NA	NA	YES	NSL
Silver	2.6	5.9	mg/kg	4 / 7	0.7 - 1.7	5.9	NA	390	NO	BSL
Thallium	ND	ND	mg/kg	0 / 7	0.3 - 1.2	1.2	NA	5.5	NO	BSL
Zinc	45.8	652	mg/kg	7 / 7	NA	652	NA	23,000	NO	BSL

*EPA Region III risk-based concentrations October 1999

mg/kg = milligrams per kilogram

NA = not available

ND = not detected

COPC = chemical of potential concern

ASL = maximum concentration above screening level

BSL = maximum concentration below screening level

NSL = no screening level; chemical is retained as COPC due to uncertainty.

type of contaminant, and variability of contaminant distribution may require the establishment of multiple exposure units within a site. The town of Basin is evaluated as one exposure unit to minimize the amount of calculation used in refining risk estimates for the town and to allow rapid calculation of PRGs that can be used to develop the feasibility study in parallel to the HHRA.

Town of Basin receptors of concern consist of residents, recreational users, and workers as shown in Table 9. An SCEM is described in Section 5.2 herein to show the following potentially important exposure pathways for these receptors.

Table 9
Receptors of Concern
Town of Basin, Montana

Exposure Pathway	Residents	Workers	Recreationists
Air	Inhalation*		Inhalation
Soil/Mine Waste	Ingestion	Ingestion	Ingestion
Subsurface Soil		Ingestion	
Interior Dust	Ingestion	Ingestion	
Surface Water, Recreational Purposes	Ingestion*		Ingestion
Surface Water, Domestic Purposes	Ingestion		
Sediments	Ingestion*		Ingestion
Groundwater	Ingestion		

* Although the pathway is potentially complete for residents who may recreate in the Town of Basin, exposure assumptions are expected to be similar to those used to evaluate out of town recreationists. The pathway is quantitatively evaluated for recreationists and the result may be applied to residents as appropriate.

Because of the uncertainty associated with estimates of exposure, 95th percentile upper confidence limits (95 percent UCL) of the arithmetic mean are generally used in HHRAs as the exposure point concentration. As described above, assessing the town as a single exposure unit was one means employed to streamline the process. Although the Town of Basin is small, smaller exposure units probably exist within the town. In such case, 95 percent UCL of the arithmetic mean would probably not represent the possible range of exposures for potential smaller exposure units within the town. As a means of expressing the potential range of possible exposure point concentrations, the 95 th percentile of the entire data set is used to represent reasonable maximum exposure (RME) estimates. The 95 percent UCL is used to represent central tendency exposure (CTE) estimates.

Pathway-specific exposure assumptions used to calculate intake are based on regional data (when available) and EPA default exposure assumptions. Regional data from mining sites as well as data from non- regional mining sites indicate that the arsenic bioavailability estimates used in this exposure assessment are overly conservative, especially those used for RME (80 percent). Studies performed by the University of Missouri showed arsenic bioavailability of 10 to 60 percent in mining wastes (EPA 1997a). Other studies have shown arsenic bioavailability of approximately 20 percent in mining wastes (EPA 1996, 1997b). Based on this information, CTE estimates using a bioavailability of 50 percent are more representative (and probably still overestimated) arsenic bioavailability. Regional studies of urinary arsenic levels indicate that measured levels are in reasonable agreement with levels predicted based on CTE assumptions and site-specific bioavailability estimates (EPA 1996).

All nondetect data were assigned one-half their contract reporting limit value. Data were assumed to be lognormally distributed; data were transformed using the natural logarithm function for calculation of exposure point concentrations. In some instances, the 95 percent UCL may be greater than the maximum detected concentration due to high variability in the data. Therefore, the lesser of the maximum concentration and the 95 percent UCL was used to represent the average exposure point concentration. Average and upper level estimates of exposure point concentrations for different media are presented in Tables 10 through 14.

Exposure point concentrations for the Town of Basin are conservative and unlikely to underestimate soil concentrations to which town residents could be exposed. For arsenic, the exposure point concentration for surface soils calculated for CTE estimates exceeds all but 65 of 352 separate data points within the town (Figure 11). Since higher arsenic concentrations are generally widely distributed and many occur in waste piles, not residential yards, this exposure point concentration is likely to reasonably represent the upper range of arsenic concentrations that residents could contact on a regular basis (CDM Federal 2000a).

A similar interpretation is appropriate for the exposure point concentration for lead used in CTE calculations. In this case, the exposure point concentrations exceed all but 59 of 329 data points (Figure 12). Higher lead concentrations in soils and wastes in the town are also widely dispersed, and this exposure point concentration is likely to reasonably represent the upper range of lead concentrations that young children could contact on a regular basis (CDM Federal 2000c).

Exposure point concentrations used for RME calculations are very conservative. Only 17 of 352 and 16 of 329 data points exceed these concentrations for arsenic and lead, respectively (Figures 11 and 12). Exposures based on these calculations would be appropriate only for people living on or very near waste piles where arsenic and/or lead concentrations were highest. Although some people do live near some of the mining waste in the community, few, if any, seem likely to be exposed to the highest measured concentrations on a daily basis. Exposure point concentrations used for RME probably represent an upper bound or ceiling on the potential for exposure and risk in the community.

7.1.3 Toxicity Assessment

Quantitative toxicity criteria are generally numerical expressions developed by EPA of the relationship between chronic average daily dose (exposure) and toxic response (adverse health effects). As described below, separate toxicity criteria are developed for assessment of carcinogenic and noncarcinogenic health effects.

Carcinogenic toxicity criteria are usually provided as cancer slope factors (CSFs) in units of excess risk per (mg/kg-day)-1 . These factors are based on the assumption that no threshold exists for carcinogenic effects and any dose is associated with some finite carcinogenic risk. Chemical- specific CSFs are provided in Table 15.

Toxicity criteria for noncarcinogens, or for significant noncarcinogenic effects caused by carcinogens, are provided as reference doses (RfD) for oral and inhalation exposure and are expressed in units of milligram of chemical per kilogram of body weight per day (mg/kg-day). RfDs may be interpreted as thresholds below which adverse effects are not expected to occur even in the most sensitive populations. Chemical-specific toxicity criteria for noncarcinogens are presented in Table 16.

EPA has not published conventional quantitative toxicity criteria for lead because available data suggest a very low or possibly no threshold for adverse effects, even at exposure levels that might be considered background. Any significant increase above such background exposures could represent a cause for some concern.

TABLE 10

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - SURFACE SOIL

TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Surface soil
Exposure Medium: Surface soil
Exposure Point: Contact with soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of arithmetic mean of Lognormal Data	Maximum Detected Concentration	Exposure Point Concentration Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Antimony	mg/kg	5.7251838	4.3E+00	3.3E+02	mg/kg	8.8213764	95%-data	PJ	4.3232911	95% UCL-T	95% UCL < Max
Arsenic	mg/kg	70.57017	5.9E+01	2.8E+03	mg/kg	179.20256	95%-data	PJ	58.655332	95% UCL-T	95% UCL < Max
Cadmium	mg/kg	2.0252022	1.3E+00	1.0E+02	mg/kg	3.7822479	95%-data	PJ	1.3128082	95% UCL-T	95% UCL < Max
Iron	mg/kg	14350.368	1.5E+04	2.0E+05	mg/kg	27268.834	95%-data	PJ	14791.173	95% UCL-T	95% UCL < Max
Lead	mg/kg	372.69394	2.6E+02	2.8E+04	mg/kg	788.60192	95%-data	PJ	260.10881	95% UCL-T	95% UCL < Max
Manganese	mg/kg	522.05294	5.6E+02	6.0E+03	mg/kg	1287.7285	95%-data	PJ	564.00059	95% UCL-T	95% UCL < Max
Mercury	mg/kg	0.302381	6.2E-01	2.2E+00	mg/kg	1.273552	95%-data	PJ	0.6160348	95% UCL-T	95% UCL < Max
Zinc	mg/kg	649.14118	3.7E+02	7.8E+04	mg/kg	1004.7358	95%-data	PJ	365.02171	95% UCL-T	95% UCL < Max

UCL = upper confidence limit

EPC = exposure point concentration

Max = maximum detected concentration. Used when the 95% UCL of the arithmetic mean of lognormal data is greater than the maximum detected concentration.

95% UCL-T = 95 percent upper confidence limit of arithmetic mean of log-transformed data

95%-data = 95 percentile of data

PJ = professional judgement. This alternative approach is used to provide some indication of the range of possible exposure point concentrations. This approach is appropriate for an assessment that focuses on remediation goals

95% UCL > max = the 95% UCL is greater than the maximum detected concentration, therefore, the maximum detected concentration is used as the exposure point concentration.

95% UCL < max = the 95% UCL is appropriate for use as the exposure point concentration.

TABLE 11
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - SUBSURFACE SOIL
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Subsurface soil
Exposure Medium: Subsurface soil
Exposure Point: Contact with soil

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of arithmetic mean of Lognormal Data	Maximum Detected Concentration	Exposure Point Concentration Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	32.236166	3.4E+01	7.5E+02	mg/kg	92.705642	95%-data	PJ	34.297974	95% UCL-T	95% UCL < Max
Iron	mg/kg	14626.635	1.6E+04	4.3E+04	mg/kg	28995.538	95%-data	PJ	15689.532	95% UCL-T	95% UCL < Max
Lead	mg/kg	146.18403	1.6E+02	3.0E+03	mg/kg	481.58447	95%-data	PJ	164.29523	95% UCL-T	95% UCL < Max
Zinc	mg/kg	493.84038	3.0E+02	3.5E+04	mg/kg	846.86069	95%-data	PJ	304.84794	95% UCL-T	95% UCL < Max

UCL = upper confidence limit
EPC = exposure point concentration
Max = maximum detected concentration. Used when the 95% UCL of the arithmetic mean of lognormal data is greater than the maximum detected concentration.
95% UCL-T = 95 percent upper confidence limit of arithmetic mean of log-transformed data
95%-data = 95 percentile of data
PJ = professional judgement. This alternative approach is used to provide some indication of the range of possible exposure point concentrations. This approach is appropriate for an assessment that focuses on remediation goals
95% UCL > max = the 95% UCL is greater than the maximum detected concentration, therefore, the maximum detected concentration is used as the exposure point concentration.
95% UCL < max = the 95% UCL is appropriate for use as the exposure point concentration.

TABLE 12
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - GROUNDWATER
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Contact with groundwater

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of arithmetic mean of Lognormal Data	Maximum Detected Concentration	Exposure Point Concentration Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/L	0.0017829	3.0E-03	3.4E-03	mg/L	0.0041478	95%-data	PJ	0.0030471	95% UCL-T	95% UCL < Max
Lead	mg/L	0.0014463	3.3E-03	3.0E-03	mg/L	0.004044	95%-data	PJ	0.003	Max	95% UCL > Max
Mercury	mg/L	6.825E-05	1.2E-04	ND	NA	0.000147	95%-data	PJ	0.0001154	95% UCL-T	95% UCL < Max

UCL = upper confidence limit
EPC = exposure point concentration
Max = maximum detected concentration. Used when the 95% UCL of the arithmetic mean of lognormal data is greater than the maximum detected concentration.
95% UCL-T = 95 percent upper confidence limit of arithmetic mean of log-transformed data
95%-data = 95 percentile of data
PJ = professional judgement. This alternative approach is used to provide some indication of the range of possible exposure point concentrations. This approach is appropriate for an assessment that focuses on remediation goals
95% UCL > max = the 95% UCL is greater than the maximum detected concentration, therefore, the maximum detected concentration is used as the exposure point concentration.
95% UCL < max = the 95% UCL is appropriate for use as the exposure point concentration.

TABLE 13
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - SURFACE WATER
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Surface water
Exposure Medium: Surface water
Exposure Point: Contact with surface water

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of arithmetic mean of Lognormal Data	Maximum Detected Concentration	Exposure Point Concentration Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Antimony	mg/L	0.0222944	1.2E-01	5.2E-02	mg/L	0.1071327	95%-data	PJ	0.0524	Max	95% UCL > Max
Arsenic	mg/L	0.0066356	1.4E-02	1.0E-02	mg/L	0.0183974	95%-data	PJ	0.01	Max	95% UCL > Max
Cadmium	mg/L	0.0277156	2.6E-01	2.4E-01	mg/L	0.0464572	95%-data	PJ	0.237	Max	95% UCL > Max
Copper	mg/L	1.4082444	5.8E+02	1.3E+01	mg/L	1.2610986	95%-data	PJ	12.6	Max	95% UCL > Max
Lead	mg/L	0.147935	7.7E+00	1.4E+00	mg/L	0.2569714	95%-data	PJ	1.42	Max	95% UCL > Max
Manganese	mg/L	0.9557	4.2E+02	8.4E+00	mg/L	1.6884516	95%-data	PJ	8.39	Max	95% UCL > Max
Mercury	mg/L	8.739E-05	1.4E-04	2.0E-04	mg/L	0.0001558	95%-data	PJ	0.0001393	95% UCL-T	95% UCL < Max
Thallium	mg/L	0.0009616	1.2E-03	na	mg/L	0.0015721	95%-data	PJ	0.0012029	95% UCL-T	95% UCL < Max

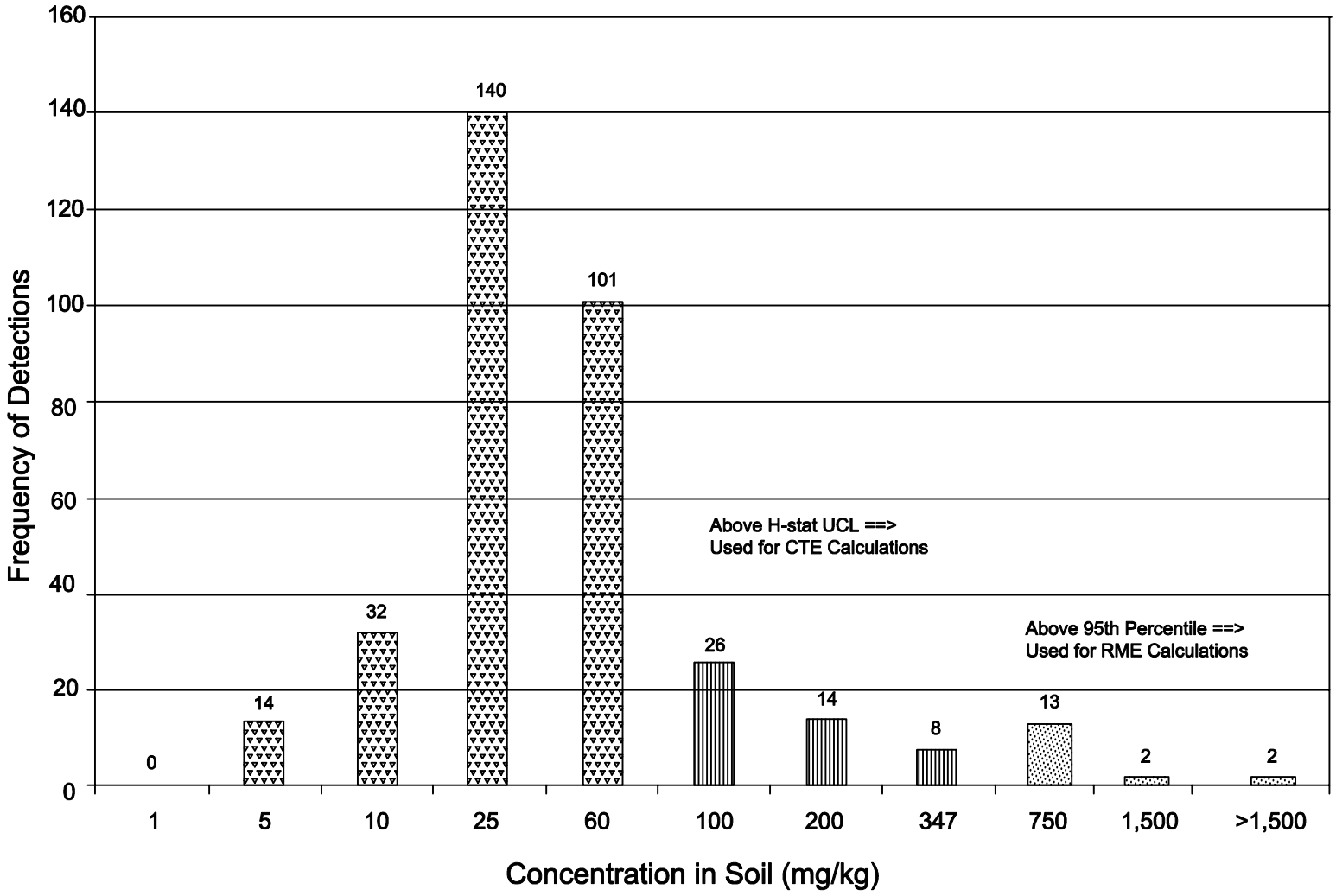
UCL = upper confidence limit
EPC = exposure point concentration
Max = maximum detected concentration. Used when the 95% UCL of the arithmetic mean of lognormal data is greater than the maximum detected concentration.
95% UCL-T = 95 percent upper confidence limit of arithmetic mean of log-transformed data
95%-data = 95 percentile of data
PJ = professional judgement. This alternative approach is used to provide some indication of the range of possible exposure point concentrations. This approach is appropriate for an assessment that focuses on remediation goals
95% UCL > max = the 95% UCL is greater than the maximum detected concentration, therefore, the maximum detected concentration is used as the exposure point concentration.
95% UCL < max = the 95% UCL is appropriate for use as the exposure point concentration.

TABLE 14
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY - SEDIMENT
TOWN OF BASIN, MONTANA

Scenario Timeframe: Current residential
Medium: Sediment
Exposure Medium: Sediment
Exposure Point: Contact with sediment

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of arithmetic mean of Lognormal Data	Maximum Detected Concentration	Exposure Point Concentration Units	Reasonable Maximum Exposure			Central Tendency		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	mg/kg	58.742857	3.4E+02	1.3E+02	mg/kg	228.00441	95%-data	PJ	131	Max	95% UCL > Max
Lead	mg/kg	258.74286	1.4E+04	1.3E+03	mg/kg	1282.0746	95%-data	PJ	1300	Max	95% UCL > Max
Mercury	mg/kg	0.0964286	2.2E-01	2.1E-01	mg/kg	0.2421143	95%-data	PJ	0.21	Max	95% UCL > Max

UCL = upper confidence limit
EPC = exposure point concentration
Max = maximum detected concentration. Used when the 95% UCL of the arithmetic mean of lognormal data is greater than the maximum detected concentration.
95% UCL-T = 95 percent upper confidence limit of arithmetic mean of log-transformed data
95%-data = 95 percentile of data
PJ = professional judgement. This alternative approach is used to provide some indication of the range of possible exposure point concentrations. This approach is appropriate for an assessment that focuses on remediation goals
95% UCL > max = the 95% UCL is greater than the maximum detected concentration, therefore, the maximum detected concentration is used as the exposure point concentration.
95% UCL < max = the 95% UCL is appropriate for use as the exposure point concentration.



Town of Basin
Basin, Montana

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Frequency Chart of Arsenic Data in Surface Soil

Figure No.
11

3/01

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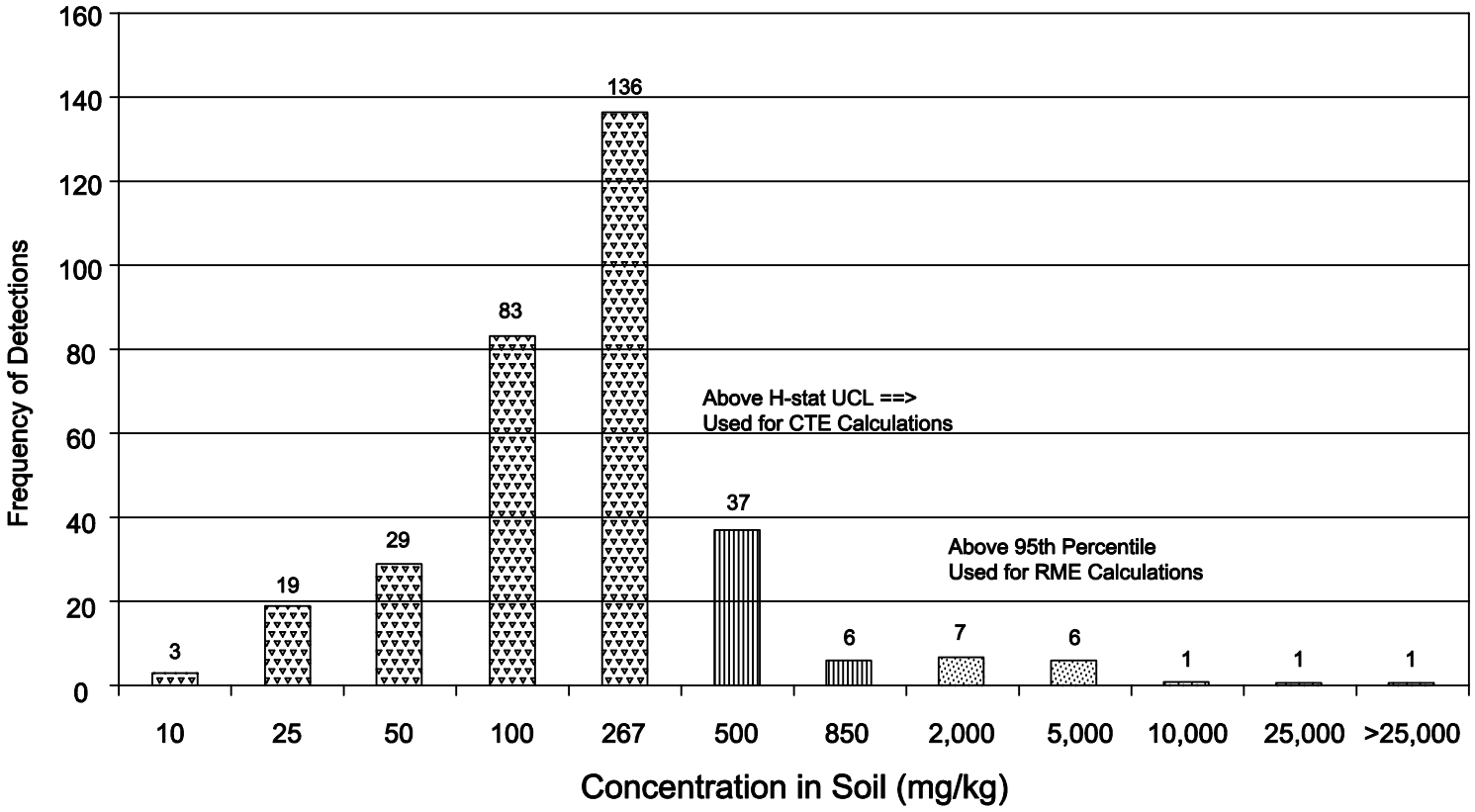

Town of Basin
Basin, Montana

CDM Federal Programs Corporation
A subsidiary of Camp Dresser & McKee Inc.

Frequency Chart of Lead Data in Surface Soil

Figure No.
12

3/01

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TABLE 15
CANCER SLOPE FACTORS

Chemical Name	Carcinogen	Cancer Class		Oral		Inhalation	
		Oral	Inh	CSF[1]	Ref	CSF[1]	Ref
Antimony	NC	D	D	NA	NA	NA	NA
Arsenic	C	A	A	1.50E+00	I	1.50E+01	I
Cadmium	C	B1	B1	NA	NA	6.30E+00	I
Copper	NC	D	D	NA	NA	NA	NA
Iron	NC	D	D	NA	NA	NA	NA
Lead	C	B2	B2	NA	NA	NA	NA
Manganese	NC	D	D	NA	NA	NA	NA
Mercury	NC	D	D	NA	NA	NA	NA
Thallium	NC	D	D	NA	NA	NA	NA
Zin	NC	D	D	NA	NA	NA	NA

[1] Notes: (milligrams per kilogram^{-1}-day)
C = carcinogen
NC = noncarcinogen
Inh = inhalation
I = IRIS (Integrated Risk Information System)
CSF = cancer slope factor
Ref = reference
NA = not available/not applicable
NE = not fully evaluated

Cancer Class:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are
B2 - Probable human carcinogen - indicates sufficient evidence in anim
inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

In lieu of evaluating risk using typical intake calculations and toxicity criteria, EPA has developed a biokinetic computer model for prediction of blood-lead levels in children exposed to lead from a variety of sources, including soil, dust, air, diet, lead-based paint, and maternal blood. Estimated blood- lead levels are compared to target blood-lead concentrations to assess possible risks.

The model can be used to assess risks to individual children or a population of children. For a single child, risk is calculated as the probability that the child's blood-lead level will exceed the level of concern (10 micrograms per deciliter [µg/ dL]). The single-child assessment is generally used to evaluate remedial options on a house-by-house or yard-by-yard basis. For a population of children, risk is expressed as the percentage of children that are likely to have a blood lead level greater than 10 µg/dL. This HHRA evaluates lead risks to populations of children. Protection of young children is considered achieved when model results indicate that 5 percent or less of the population of children will have blood-lead levels greater than 10 µg/dL. Because children between the ages of 0 to 6 are thought to be most susceptible to the adverse effects of lead, protection for this age group (0 to 6 years old) is assumed to also protect older individuals. The model can also be used to calculate risk- based PRGs for lead and is used in this report for that purpose.

7.1.4 Risk Characterization

In the risk characterization, chemical intake, and toxicity estimates are combined to develop cancer and noncancer health effects estimates. Risk estimates were developed using sitewide concentrations for COPCs. Cancer risk estimates for residents, commercial workers, and recreationists are summarized in Table 17 and noncancer health effects estimates in Table 18.

As outlined in the NCP, incremental cancer risks to an individual are generally considered acceptable in the range from 1 in 1,000,000 (1 x 10-6) to 1 in 10,000 (1 x 10-4). Current cancer risks due to exposure to arsenic in soils in the Town of Basin could be as high as 2 in 10,000 (2 x 10-4) for residents in contact with the most contaminated soil, found during the RI.

A target hazard index for evaluation of non-cancer hazards defined by EPA as the upper limit for acceptable exposure is one. Most possible exposures for people living, working, or recreating in town are at or below this target.

TABLE 16
REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN

Chemical Name	Oral		Inhalation	
	RfD[1]	Reference	RfD[1]	Reference
Antimony	4.0E-04	I	NA	NA
Arsenic	3.0E-04	I	NA	NA
Cadmium	5.0E-04	I	NA	NA
Copper	3.7E-02	[2]	NA	NA
Iron	3.0E-01	NCEA	NA	NA
Lead	IEUBK	I	NA	NA
Manganese	4.7E-02	I[3]	1.43E-05	I
Mercury	3.0E-04	HEAST	8.60E-05	I
Thallium	7.0E-05	EPA R3	NA	NA
Zin	3.0E-(	]	NA	NA

Notes:

[1] Units are mg/kg-day

[2] RfD is calculated from Maximum Contaminant Level Goal (MCLG)

[3] RfD is for water

CAS = Chemical Abstract Service
No. = number
RfD = reference dose
I = IRIS (Integrated Risk Information System)
NA = not available/not applicable
HEAST = Health Effects Assessment Summary Tables
IEUBK = Integrated Exposure Uptake Biokinetic model
NCEA = National Center for Environmental Assessment
NA = not available/applicable
EPA R3 = Toxicity Criteria used by EPA Region 3

Table 17
Summary of Cancer Risk Estimates

Exposure Pathway	Receptor Population: Resident CTE	Resident RME	Commercial Worker CTE	Commercial Worker RME	Recreationist CTE	Recreationist RME
Ingestion of Soil/Mine Waste	3E-06*	2E-04	8E-07	3E-05	4E-07	3E-05
Inhalation of House Dust	2E-06	1E-04	4E-07	3E-05		
Ingestion of Groundwater	1E-05	1E-04				
Ingestion of Surface Water (Potable Purposes)	4E-05	5E-04	5E-07	2E-05		
Ingestion of Subsurface Soil						
Ingestion of House Dust Derived from Subsurface Soil			2E-07	1E-05		
Ingestion of Sediment					4E-07	2E-05
Ingestion of Surface Water					1E-07	3E-06
Inhalation of Air					3E-06	3E-04

* 0.000003, typical
Note: This table shows the number of excess cancers anticipated for the receptor population given the exposure pathway.

Table 18
Summary of Hazard Indices

Exposure Pathway	Receptor Population: Resident CTE	Resident RME	Commercial Worker CTE	Commercial Worker RME	Recreationist CTE	Recreationist RME
Ingestion of Soil/Mine Waste	0.1	1	0.03	0.3	0.01	0.2
Inhalation of House Dust	0.1	0.9	0.02	0.2	-	-
Ingestion of Groundwater	0.2	0.6	-	-	-	-
Ingestion of Surface Water (Potable Purposes)	21	22	-	-	-	-
Ingestion of Subsurface Soil	-	-	0.02	0.2	-	-
Ingestion of House Dust Derived from Subsurface Soil	-	-	0.01	0.1	-	-
Ingestion of Sediment	-	-	-	-	0.01	0.1
Ingestion of Surface Water	-	-	-	-	0.08	0.14
Inhalation of Air	-	-	-	-	1	19

7.1.4.1 Risk Characterization Uncertainty

As with any risk assessment, uncertainties are inherent in the estimation of potential risks. These uncertainties are detailed below.

Exposure Units

To help streamline the risk assessment and to reflect the focus of the assessment on development of PRGs, the Town of Basin OU1 was not divided into separate exposure units. Modified definitions of RME and CTE were used to help address possible concerns with this approach and to allow use of regional exposure information. Thus, RME and CTE risks are interpreted somewhat differently for this site. RME-based risks probably represent upper-bound or ceiling values that could fall above those possible for the site; CTE-based risks are probably more reasonable risk estimates, although they probably do not represent "average" risks for the town. Even CTE exposure assumptions are conservative because of lack of site-specific data.

The above considerations suggest that upper range risks for the Town of Basin may lie close to those predicted use CTE assumptions, but could be as high as those estimated using RME assumptions. The latter seems unlikely given the large amounts of regional data, and the similarity of the Basin site with others in the region. Risks at or close to "average" may not be represented in the risk estimates provided; "average" risks are probably lower than those estimated using CTE assumptions.

Acute Exposure to Arsenic

EPA Region VIII has proposed an interim "subchronic RfD" for evaluation of short-term exposure to arsenic. This toxicity criterion reflects the observation that some skin lesions appear in the Taiwanese population in very young children (Tseng et al 1968). This observation suggests that chronic exposure, often defined as exposure lasting 7 years or longer, may not be necessary to observe adverse health effects.

Toxicity information is not sufficient to determine if a single exposure to arsenic in soil might result in arsenic induced skin lesions or other effects. Daily exposure over a period of weeks or months could conceivably be required before effects like those seen in the Taiwanese population are observed. Thus, setting remediation goals based on acute exposure is highly uncertain and is not attempted in this assessment.

Arsenic Toxicity Criteria

Regional guidance recommends recognizing uncertainties in the arsenic CSF, but making no changes in the CSF for purposes of quantitative risk assessment, and this approach is taken in this risk assessment. It is assumed that uncertainties in the arsenic oral CSF are best taken into account in the risk management process.

Bioavailability Data

Bioavailability of arsenic in wastes from mining and smelting activities is recognized as an important factor in human exposure. Site-specific bioavailability factors (BAFs) for arsenic in soil and interior dust are not available. Therefore, regional estimates of arsenic bioavailability of 50 percent were used in this HHRA. Bioavailability may vary depending upon the source and processes resulting in production of the wastes (i.e., tailings, waste piles). It is not known whether wastes in the Town of Basin OU1 differ significantly from regional wastes. Therefore, there is uncertainty associated with the use of regional estimates of arsenic bioavailability. It is not possible to determine at this time if the BAFs used would result in over-or underestimation of risks.

Default Exposure Assumptions

Default exposure assumptions and professional judgment are used throughout the exposure assessment to estimate potential chronic daily intakes. Data are not available to determine quantitatively how each of these assumptions and judgements might influence CDI calculations. However, factors such as soil/dust ingestion rates for adults and exposure frequency and duration are at least conservative (i.e., are unlikely to underestimate possible exposures) and probably do not result in substantial overestimation.

It is reasonable to conclude that exposures calculated in this assessment are acceptable for both CTE and RME estimates.

Lack of Interior Dust Data

Historical data were not available to characterize chemical concentrations in interior dust. For residents and workers, exposure to solid media is apportioned between soil and interior dust. Due to the lack of data for interior dust, an estimated transfer coefficient of the contribution of exterior soil to chemical concentrations in interior dust was used to estimate chemical concentrations in interior dust. Over-or underestimation of the transfer coefficient could result in over-or underestimation of exposure and risk. Regional data suggest that transfer coefficients are likely to be less than the default value of 0.7 taken from the Integrated Exposure Uptake Biokinetic (IEUBK) model for estimates of RME. Regional values for arsenic and lead obtained from work performed at Anaconda and Butte, respectively are thought to reasonably represent soil-to- dust transfer for the Town of Basin. However, these values (43 percent for arsenic, 24 percent for lead) could either over-or underestimate actual transfers for this site.

7.2 Ecological Risks

Risk to the environment (plants, animals, etc.) will be assessed in an upcoming ecological risk assessment for OU2.

7.3 Risk-Based Preliminary Remediation Goals

Risk-based PRGs for soils were calculated using the same regional and EPA default assumptions used in intake calculations, as well as ranges for target cancer risks and non-cancer hazards commonly used by EPA. Table 19 presents the PRGs determined for lead, arsenic, and manganese. These are further discussed in Section 12.

Table 19
Preliminary Remediation Goals - Soil

COC	Exposure Use	PRG	Basis for PRG
Arsenic	Residential	120 mg/kg	cancer risk = 1 x 10-5
Lead	Residential	1,000 mg/kg	IEUBK model
Manganese	Recreational	469 mg/kg	non-cancer risk, hazard quotient = 1

7.4 Summary of Risks/Basis of Action

The response action selected in this ROD for OU1 is warranted to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment and of pollutants or contaminants that may present an imminent and substantial endangerment to public health or welfare.

Section 8
Remedial Action Objectives

This ROD was prepared according to EPA guidance (EPA 1999a). The remedy outlined in this ROD is intended to be the final remedial action for OU1. Remedial action objectives (RAOs) are medium-specific (e.g., residential soil, mine waste, etc.) goals for protecting human health and the environment. The RAOs for OU1 are to:

- Prevent direct exposure of the population to elevated contaminant concentrations in residential soil and mine waste.

- Control erosion of contaminated soil by wind and water from the source locations.

- Control airborne transport of mine waste particles, especially fine-grained materials such as tailings.

- Control erosion of mine waste into local water courses.

- Control leaching and migration of contaminants from mine waste into surface water and groundwater.

To achieve the RAOs presented above, EPA has also developed PRGs for OU1 in the HHRA. These PRGs were used to develop cleanup levels discussed in Section 12.

Section 9
Description of Alternatives

The remedial alternatives for OU1 evaluated in the FS are presented in this section. The preferred alternative identified in the Proposed Plan for OU1 is Alternative 4-Removal/ Transportation/Disposal (Luttrell Repository)/ Institutional Controls. Alternative 4 has been subsequently modified as described in Section 12, Selected Remedy.

Note that the capital cost presented in this section of the ROD includes expenses related to the labor, equipment, and material costs of construction. The operations and maintenance (O&M) cost refers to the cost and time frame of operating labor, maintenance, materials, energy, disposal, and administrative activities following completion of the remedial activities. Periodic costs refer to costs that occur occasionally throughout the life of the project such as the preparation of Five-Year Review Reports. Present Value, also known as Net Present Worth, provides an analysis of the current value of all costs. Present Value cost is calculated based on a predetermined interest rate and the time period over which the remedy will be completed.

Each alternative as evaluated in the Feasibility Study (except the “no action” alternative) requires excavation of all contaminated soil from residential yards and the Basin School Yard, and disposal of the soil at a disposal facility (either a local mine waste repository, Luttrell Repository, or an offsite Resource Conservation and Recovery Act [RCRA] Subtitle D landfill). In Alternatives 3, 4, and 5, all of the contaminated soils associated with the streamside tailings and the Jib Tailings will be removed. In addition, removing 2 feet of soil is no longer the goal but rather wastes will continue to be excavated as they are encountered.

Note: *The Selected Remedy was modified to include removal of all contaminated material. In addition, the Basin Mill site was removed from the remedial action. Section 12 (as described in Section 12.3) provides the revised waste volumes and costs associated with the Selected Remedy. The discussion presented below is taken from the FS and does not include these revisions made to the Selected Remedy.*

9.1 Alternative 1 - No Action

Estimated Capital Cost:	**$0**
Annual O&M Cost (1-30 years):	**$0**
Periodic Cost:	**$17,700**
Estimated Present Value:	**$38,200**

Regulations governing the Superfund program require that the “no action” alternative be evaluated to establish a baseline for comparison to other alternatives. Under Alternative 1, contamination would be left “as- is.” No remedial action would be taken to reduce toxicity, mobility, or volume of contaminated mine waste or residential soil. There would be no protection of human health or the environment, and PRGs would not be met for the site. Preparation of 5-year site reviews are included in the periodic costs.

9.2 Alternative 2 - Containment (Surface Water Control, Source Surface Control)/Removal/Institutional and Non-Engineering Controls

Estimated Capital Cost:	**$2,639,700**
Annual O&M Cost (1-30 years):	**$14,600**
Periodic Cost:	**$17,700**
Estimated Present Value:	**$2,859,100**

The containment portion of this alternative includes surface water and source surface controls. Surface water control includes containment with either diversion ditches or

channelization. Diversion ditches divert surface water streams and run-on away from and around the contaminated areas. Channelization involves constructing lined channels through contaminated areas to control surface water flow. These options would likely reduce the potential for transport of contamination away from the source and for contamination of surface water. Source surface control involves the installation of either vegetation, a simple cover, or an asphalt pavement cover over mine waste to limit exposure of waste to the environment and limit infiltration of precipitation.

The removal component of this alternative involves mechanical excavation of residential soils using conventional earthmoving equipment. Due to the low volume of residential soils, the excavated material would be transported by truck to the Luttrell Repository for disposal, approximately 15 miles north of Basin. Areas excavated below ground surface would be backfilled to the surrounding ground level and graded to drain. Depending on previous conditions, the backfilled areas would be sodded or surfaced with gravel.

Institutional and non-engineering controls for mine waste sites include proprietary controls (covenants and easements), fencing and posted warnings, and information and educational programs. The proprietary controls would legally limit or regulate future land use in the source area. Fencing and posted warnings would be installed around the perimeter of the deposits to prevent or minimize potential for human and animal access to the area. Posted warnings would identify potential hazards to which trespassers could be exposed. Alternative 2 also includes 5-year site reviews.

Anticipated O&M costs include maintenance of the ditches and covers.

9.3 Alternative 3 - Removal/Transportation/Disposal (Onsite Repository)/Institutional Controls

Estimated Capital Cost:	**$5,571,600**
Annual O&M Cost (1-30 years):	**$89,100**
Periodic Cost:	**$17,700**
Estimated Present Value:	**$6,700,200**

Alternative 3 includes removal, transport, and disposal of contaminated residential soils and mine waste. The residential soils and mine waste would be mechanically excavated using conventional earthmoving equipment and transported by truck to a newly constructed onsite repository located near the town of Basin for disposal. Areas excavated below ground surface would be backfilled to the surrounding ground level and graded to drain. Depending on previous conditions, the backfilled areas would be sodded or surfaced with gravel.

The onsite repository would be at a yet-to-be-determined location near the town of Basin. The repository would be constructed using man- made materials and clean soil to provide complete containment of wastes and limit infiltration of precipitation. Institutional controls in the form of covenants and easements are included to regulate future excavations deeper than the removal activities in areas where contamination is left in place (WWTP, Basin Street Tailings, and Basin Mill Site). Alternative 3 also includes monitoring well installation at the repository, monitoring of the newly-installed wells, O&M of the onsite repository, and 5-year site reviews.

9.4 Alternative 4 - Removal/Transportation/Disposal (Luttrell Repository)/Institutional Controls

This alternative has undergone minor modifications as a result of comments received on the Proposed Plan. Refer to Section 12 for a complete description of the revised alternative and updated costs.

Estimated Capital Cost:	**$4,144,300**
Annual O&M Cost (1-10 years):	**$44,600**
Annual O&M Cost (11-30 years):	**$1,300**
Periodic Cost:	**$17,700**
Estimated Present Value:	**$4,502,700**

Alternative 4 includes removal, transport, and disposal of contaminated residential soils and mine waste. The residential soils and mine waste would be mechanically excavated using conventional earthmoving equipment and transported by truck to the Luttrell Repository, approximately 15 miles north of Basin. Areas excavated below ground surface would be backfilled to the surrounding ground level and graded to drain. Depending on previous conditions, the backfilled areas would be sodded or surfaced with gravel. Institutional controls in the form of covenants and easements are included to regulate future excavations deeper than the removal activities in areas where contamination is left in place (WWTP, Basin Street Tailings, and Basin Mill Site). Alternative 4 includes operations costs at the Luttrell Repository and 5-year site reviews.

9.5 Alternative 5 - Removal/Transportation/Disposal (Subtitle D Landfill)/Institutional Controls

Estimated Capital Cost:	**$10,352,700**
Annual O&M Cost (0-10 years):	**$0**
Annual O&M Cost (10-30 years):	**$0**
Periodic Cost:	**$17,700**
Estimated Present Value:	**$10,390,900**

Alternative 5 includes removal, transport, and disposal of residential soil and mine waste. The residential soil and mine waste would be mechanically excavated using conventional earthmoving equipment and transported by truck to an offsite RCRA Subtitle D landfill.

Areas excavated below ground surface would be backfilled to the surrounding ground level and graded to drain. Depending on previous conditions, the backfilled areas would be sodded or surfaced with gravel. Institutional controls in the form of covenants and easements are included to regulate future excavations deeper than the removal activities in areas where contamination is left in place (WWTP, Basin Street Tailings, and Basin Mill Site). Alternative 5 also includes 5-year site reviews. There are no anticipated O&M costs for this alternative.

Section 10
Summary of Comparative Analysis of Alternatives

Section 300.430(e)(9) of the NCP requires that the EPA evaluate and compare the remedial cleanup alternatives based on the nine criteria listed below. The first two criteria, (1) overall protection of human health and the environment and (2) compliance with applicable or relevant and appropriate requirements (ARARs), are threshold criteria that must be met for the Selected Remedy. The Selected Remedy must then represent the best balance of the remaining primary balancing and modifying criteria.

10.1 NCP Evaluation and Comparison Criteria

10.1.1 Threshold Criteria

(1) **Overall protection of human health and the environment** addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled.

(2) **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** addresses whether or not a remedy will comply with identified federal and state environmental and citing laws and regulations. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

10.1.2 Primary Balancing Criteria

(3) **Long-term effectiveness and permanence** refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean- up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

(4) **Reduction of toxicity, mobility, and volume** refers to the preference for a remedy that reduces health hazards, the movement of contamination, or the quantity of contaminant at the site through treatment.

(5) **Short-term effectiveness** addresses the period of time needed to complete the remedy and any adverse impact on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

(6) **Implementability** refers to the technical and administrative feasibilities of a remedy, including the availability of materials and services needed to carry out a particular option.

(7) **Cost** evaluates the estimated capital costs, O&M costs, and present value costs of each alternative.

10.1.3 Modifying Criteria

(8) **State acceptance** indicates whether the State (DEQ), based on its review of the information, concurs with, opposes, or has no comment on the preferred alternative.

(9) **Community acceptance** is based on whether community concerns are addressed by the Selected Remedy and whether or not the community has a preference for a remedy.

10.2 Evaluating the Alternatives with the NCP Criteria

This section summarizes the evaluation of the OU1 alternatives against the nine NCP criteria. The following subsections are a brief summary of the evaluation and comparison of the alternatives against each criteria. Additional details of the evaluation of the alternatives are presented in the FS. Table 20 provides a comparison of the five remedial action alternatives and the nine NCP criteria. Information for this section was obtained from the FS for OU1 (CDM Federal 2000a).

Table 20
Summary of Detailed Analysis of Alternatives

Alternative	Overall Protection of Human Health and the Environment Compliance with ARARs	Long-Term Effectiveness and Permanence	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility or Volume Through Treatment	Short-Term Effectiveness	Implement-ability	Cost
1	Marginal	Marginal	Marginal	Marginal	Marginal	High	Marginal
2	Moderate	High	Moderate	Marginal	High	Moderate	Moderate
3	High	High	Moderate/ High	Marginal	High	High	Moderate
4	High	High	Moderate/ High	Marginal	Moderate	High	Moderate
5	High	High	Moderate/ High	Marginal	High	High	High

10.2.1 Overall Protection of Human Health and the Environment

This criterion is based on the level of protection of human health and the environment afforded by each alternative. Alternatives 2, 3, 4, and 5 considered in the comparative analysis meet the requirements of the RAOs and provide overall protection of human health and the environment by covering or removing the source materials to prevent direct contact, control erosion and airborne transport, and minimize the potential for COPC transport to groundwater and surface water.

Alternatives 3, 4, and 5 would provide essentially an equal level of long-term protection with respect to preventing direct contact, COPC transport to surface water, and preventing airborne transport by removing the source materials present at the site and disposing of them in a repository or landfill. Alternative 2 would provide less long-term protection because the mine waste would only be protected by a vegetative or asphalt cover.

With respect to risks to the community and workers during implementation of remedial actions, Alternatives 2 and 3 would entail essentially the same low potential for risk which could be controlled by standard construction and dust control practices. Alternatives 4 and 5 would entail an increased risk due to the truck transportation of contaminated materials to an offsite disposal facility.

Overall, the highest level of protection of human health and the environment would be provided by Alternatives 3, 4 and 5, which prevent direct contact with source materials and minimize the potential for migration of COPCs to groundwater, surface water, and air.

Alternative 2 has a lower performance, because covering in place would result in a smaller reduction of infiltration through mine wastes and it would also be less desirable because all waste piles would be covered and require long-term management to maintain the remedy.

10.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 would address all of the PRGs outlined in the FS for the Town of Basin OU1 and the design and construction would be in accordance with state and Federal requirements. These alternatives would all meet ARARs.

10.2.3 Short-Term Effectiveness

Alternatives 2, 3, and 5 provide essentially the same high level of short-term effectiveness. Risks to the community and workers during the implementation of these alternatives would be low and could be controlled by standard construction and dust control practices. Alternative 4 would entail an increased risk due to the truck transportation of contaminated materials to an offsite disposal facility which would require trucks to pass through the Town of Basin. Therefore Alternative 4 has a lower performance against the criterion of short-term effectiveness than Alternatives 2,3,and 5.

10.2.4 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would provide moderate to high long- term protection of human health and the environment by covering or removing the source materials to prevent direct contact, control erosion and airborne transport, and minimize the potential for COPC transport to groundwater and surface water. Alternative 2 would provide less long- term permanence because all source material will remain in place.

10.2.5 Reduction of Toxicity, Mobility, or Volume Through Treatment

The EPA RI/FS guidance (EPA 1988) states that reduction of toxicity, mobility, or volume is only accomplished by treatment. Since waste removal is not considered treatment, Alternatives 2, 3, 4, and 5 would be marginally effective in the reduction of toxicity, mobility or volume of metal contamination.

10.2.6 Implementability

Alternatives 3, 4, and 5 could be readily implemented with available equipment and personnel using generally standard construction methods. However, suitable property for an onsite repository was not located. Alternative 2 would be more difficult to implement because this alternative would involve construction activities at each source area. Also, maintenance of the covers would be more labor intensive than a single cover because of the numerous source areas and access requirements that must be maintained at each of these waste sources. The authorizations required for the legal restriction components of institutional controls for the source areas could be difficult to obtain and maintain.

10.2.7 Cost Analysis

The estimated present worth costs for the alternatives, not including the No Action alternative, range from $2.9 million for Alternative 2 to $10.4 million for Alternative 5.

Alternatives 4 and 5 provide essentially the same level of overall protection of human health and the environment. However, Alternative 5 would entail higher costs than Alternative 4 and, therefore, Alternative 4 would be more cost-effective.

10.2.8 State Acceptance

The State has been consulted throughout this process and concurs with the Selected Remedy, Alternative 4, as modified in this Record of Decision.

10.2.9 Community Acceptance

Public comment on the RI, FS, and Proposed Plan was solicited during a formal public comment period extending from January 2 to February 2, 2001. Comments generally favored the Preferred Alternative and modifications have been made to the Selected Remedy to address community concerns. Appendix A contains a summary of community responses to the Selected Remedy.

Section 11
Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by the site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Conversely, non- principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

The source materials identified at the OU1 site include contaminated residential and non-residential soils, tailing s, ore piles, and waste rock piles. These source materials do not constitute principal threat wastes; hence, they are considered non- principal threat wastes. Containment of the source materials using a repository and soil covers are reliable remedies.

Section 12
Selected Remedy

Based upon consideration of CERCLA requirements, the detailed analysis of alternatives, and public comments, EPA has determined that the Removal/Transportation/Disposal(Luttrell Repository)/Institutional Controls Alternative presented in the Proposed Plan, with modifications, is the appropriate remedy for the contaminated residential soils and mine wastes at the OU1 site within the Basin Mining Area Superfund Site. The modifications to the Preferred Alternative (Alternative 4) are presented in an Addendum to the FS and discussed herein.

12.1 Rationale for Selected Remedy

Alternative 4 either meets or exceeds benefits associated with the selecting criteria compared to the majority of the other alternatives. This selected remedy will reduce risk to human health and the environment through the following:

- As required, Alternative 4 meets the threshold cleanup evaluation criteria (overall protection of human health and the environment and compliance with ARARs).
- Alternative 4 provides very good long- term effectiveness and permanence.
- Alternative 4 eliminates the source from the site.
- Alternative 4 controls the human health risks (defined by the risk assessment).
- Alternative 4 is readily implementable. The remediation technologies selected for this alternative have been successfully employed at other Superfund sites.

The Selected Remedy best meets the entire range of selection criteria and achieves, in EPA’s determination, the appropriate balance considering site- specific conditions and criteria identified in CERCLA and the NCP, as provided in Section 13, Statutory Determinations.

12.2 Description of Selected Remedy

Under the Removal/ Transportation/Disposal(Luttrell Repository)/Institutional Controls Alternative, the contaminated soil and mine wastes will be removed to a single-lined, fully encapsulated repository. The principal components of Alternative 4 are as follows:

- All of the contaminated soil will be removed from the residential yards, the streamside tailings, the WWTP tailings, Basin Street Tailings, ore pile north of Basin, and the Jib Tailings and placed in the Luttrell Repository.
- All excavations will be backfilled with clean soil and revegetated.
- Institutional controls, which are measures to control or prevent future land use, or other measures to provide information to current/ future land owners, will also be implemented, only if inaccessible wastes remain above cleanup levels and if risks associated with such mine waste are identified.
- A portion of the operation and maintenance of the Luttrell Repository will be allocated to this operable unit based on an estimate of the waste from this OU in proportion to the estimated total volume of the Luttrell Repository.

12.3 Deviation from the Proposed Plan

During the comment period of the Proposed Plan, the public expressed concern over leaving waste material in place. In addition, the state indicated that OT Mining has applied for a groundwater pollution permit for operation of the tailings impoundment at the Basin Mill site. The owner of the mill site, OT Mining Corporation, has not yet applied for a mill site operating permit. Neither permit is likely to require full reclamation of the impacts

of historic milling activities to address health concerns associated with the site. EPA and the state are currently investigating the scope of reclamation actions that could be addressed under either permit. Finally, EPA received new information on costs for O&M at the Luttrell Repository. As a result of these comments, EPA made the following changes to the Selected Remedy:

- All of the tailings from the area east of the WWTP and the Basin Street Tailings will be removed. EPA determined that the long-term effectiveness of this action would be improved with a minor increase in volume in these areas. The original revised volume estimates are found in Table 21.

Table 21
Revised Waste Areas and Volumes for Mine Waste

Location	Designation	Area (sy)	Original In-Place Volume (bcy)	Revised In-Place Volume (bcy)
Basin Mill Site				
Basin Mill Site	--	13,248	10,210	0
Maintenance Yard				
Near Basin Mill Site	T-12	114	76	76
Basin Street Tailings				
Near Basin Street	NA	2,412	1,616	1,616
Ore Pile				
North End of Town	NA	310	448	448
Jib Tailings				
Jib Tailings	NA	8,880	14,800	14,800
WWTP Tailings				
WWTP	T-9	26,319	17,634	21,470
Tailings Adjacent to Boulder River				
Pile	T-1	376	252	252
Pile	T-2a	682	457	457
Pile	T-2b	77	52	52
Pile	T-3	591	396	396
Pile	T-4	876	587	587
Pile	T-5	3,793	2,641	2,541
Pile	T-6	2,432	1,629	1,629
Pile	T-7	596	399	399
Pile	T-8	830	556	556
Pile	T-10	1,738	1,164	1,164
Subtotal		11,991	8,033	8,033
TOTAL		50,026	52,817	46,443

Notes
(1) The Ore Pile north of town is a waste pile that exists above ground surface. In-place volume calculations for this waste area is not directly correlatable to the surface area.
(2) The volume for the Jib Tailings was calculated by multiplying area by 1.67 yards (approximately 5 feet) to obtain in-place volume in bank cubic yards (bcy). Volumes for all other locations except T-9 were calculated by multiplying area by 0.67 yards (approximately 2 feet) to obtain in-place volume in bcy.
(3) Volume for T-9 was determined using AutoCad 3-D analysis. Since waste depths vary over the site, in-place volume is not directly correlatable to the surface area.
(4) Areas with arsenic and lead concentrations greater than 80 percent of the Preliminary Remediation Goals (PRGs) are included in this table.

- The waste piles and tailings remediation from the Basin Mill Site were removed from the Selected Remedy until EPA and the state can investigate and determine the scope of any reclamation that can be addressed under a state permit for the mill site. The remedy as ultimately designed and implemented will address any threats to the remedy and to human health and the environment posed by the Basin Mill site that are not adequately addressed through reclamation actions to be performed under a state permit(s). When it is known what, if any, reclamation will be accomplished under the state permit(s), the remedy will include and require all remedial actions determined appropriate to address contaminant sources that will not be addressed under the state permit(s), including, but not limited to, complete removal of all contaminated materials to the Luttrell Repository or other actions to prevent the migration of contaminants from the mill site from any waste materials left in place at the mill site.

- The cost estimate for the Selected Remedy was adjusted for the addition of waste from the WWTP area and the deletion of waste from the Basin Mill Site. In addition, revised costs were received from operations of Luttrell Repository. Appendix C contains the revised cost estimate. Table 22 presents a summary of the original and revised estimates.

Table 22
Revised Cost Estimate Summary

	Original	Revised
Estimated Capital Cost	$4,144,300	$3,757,600
Estimated Annual O&M Costs (Years 1-10)	$43,300	$10,300
Estimated Annual O&M Costs (Years 11-30)	$1,300	$1,500
Periodic Costs	$17,700	$17,700
Present Value	$4,502,700	$3,876,200

- Institutional controls will only be necessary if wastes remain in inaccessible areas such as beneath residential structures and if risks associated with such mine waste are identified.

12.4 Estimated Remedy Costs

The detailed cost estimate and present worth analysis for Alternative 4, the Selected Remedy, are presented in Appendix C. The net present value of the estimated capital and operating cost for a 30-year period is approximately $3,876, 200. The time frame to implement the remedy is anticipated to be 1 to 2 years. The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major cost changes may be documented in the form of a memorandum in the Administrative

Record file, an Explanation of Significant Differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

12.5 Expected Outcome of the Selected Remedy

The Selected Remedy for OU1 would remove the source from the site and thereby eliminate the risk to human health. The anticipated environmental and ecological benefits would minimize surface water impacts during storm events, and eliminate direct contact of humans and fauna with materials having COPC concentrations above risk-based action levels.

12.6 Cleanup Levels

Cleanup levels for the Town of Basin OU1 are the PRGs detailed in Table 19. These levels are protective of human health. Initial excavation criteria will be 80 percent of the PRGs determined for lead, arsenic and manganese. This is because EPA recognizes that analytical methods and instruments are never perfect, hence a measurement can only estimate the true value of an environmental sample. Measurement error refers to a combination of random and systematic errors that inevitably arise during the various steps of the measurement process. In addition, the population of interest almost always varies over time and space. Limited sampling will miss some features of this natural variation because it is usually impossible or impractical to measure every point of a population. Sampling design error occurs when the sampling design is unable to capture the complete extent of natural variability that exists in the true state of the environment.. The combination of sampling design error and measurement error is called total study error. Total study error may lead to a decision error.

As part of the data quality objectives (DQOs) discussed in the RI (CDM Federal 2000b), the tolerable decision error limit was defined to be 20 percent. This error limit recognizes the uncertainty associated with soil/sediment analytical results. For example, a sample with a reported concentration of 100 mg/kg could actually be 80 or 120 mg/kg due to study error. The closer the reported concentration is to the PRG and therefore the selected clean-up level, the higher probability that an incorrect decision will be made on remediation. For soil samples, EPA determined that those samples that were within 20 percent of the PRGs are in need of some type of remedial action for purposes of the ROD. Table 22 presents the PRGs (cleanup level) and the initial excavation criteria. Those areas that have contaminant concentrations in soil greater than the excavation criteria will be remediated. The excavation will be complete when contaminant concentrations throughout the area are less than the PRGs.

Table 23
PRGs and Initial Excavation Criteria

Contaminant	PRG (mg/kg)	Excavation Criteria (mg/kg)
Lead, residential	1,000	800
Arsenic, residential	120	96
Manganese, recreational	469	375

Section 13
Statutory Determinations

Under CERCLA Section 121, EPA must select a remedy that is protective of human health and the environment, that complies with ARARs, is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that include treatment which permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principle element.

13.1 Protection of Human Health and the Environment

The Selected Remedy will protect human health and the environment through the prevention of direct contact with contaminants at the site. Excavation of source materials in the residential areas and throughout Basin remove contaminants from the site. All soils with contaminant concentrations above EPA's health-based criteria will be removed. The Selected Remedy uses vegetative covers for excavated areas to control erosion. Institutional controls will be required if any waste is inaccessible and must be left in place (for example, under residential structures) and if risks associated with such mine waste are identified.

13.2 Compliance With ARARs

The Selected Remedy will comply with all ARARs identified in Appendix B for OU1 and for the use of the Luttrell Repository as a repository. No waiver of ARARs will be necessary.

13.3 Cost Effectiveness

EPA has determined that the Selected Remedy is cost effective in mitigating the principle risks posed by contaminated soils and mine wastes. Section 300.430(f)(ii)(D) of the NCP requires evaluation of cost effectiveness. Overall effectiveness is determined by the following three balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective. The Selected Remedy meets the criteria and provides for overall effectiveness in proportion to its cost. The estimated cost for the Selected Remedy is $3,876,200.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Possible

EPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions can be used in a cost effective manner at the OU1 site. The Selected Remedy removes all the waste from OU1 and transports the waste to an existing repository. This provides the highest effectiveness at the least cost.

Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the Selected Remedy for OU1 provides the best balance in terms of long- term effectiveness and permanence, treatment, implementability, cost, and state and community acceptance.

13.5 Preference For Treatment as a Principal Element

Various treatment options for contaminated soils and mine wastes were considered in the FS process; however, due to the nature and size volume of the contaminated soils and mine wastes, these options were determined to be either technically impracticable and/or not cost-effective.

13.6 Five-Year Review Requirements

If some contaminated soils and mine wastes remain onsite in inaccessible areas above levels that allow for unlimited use and unrestricted exposure, the Selected Remedy requires a 5-year review under Section 121 of CERCLA and Section 300.430(f)(4)(ii) of the NCP. The 5-year review includes a review of the groundwater and surface water monitoring data and an evaluation as to how well the Selected Remedy is achieving the RAOs and ARARs that it was designed to meet.

Section 14
Documentation of Significant Changes

The Proposed Plan for contaminated soils and mine wastes at the OU1 was released for public comment in January 2001. The Proposed Plan identified Alternative 4, Removal/ Transportation/Disposal(Luttrell Repository)/Institutional Controls, as the Preferred Alternative. Comments were received during the public comment period. EPA made the following changes to the Preferred Alternative:

- All of the tailings from the area east of the WWTP and all of the Basin Street tailings will be removed. EPA determined that the long- term effectiveness of this action would be improved with a minor increase in volume in these areas. The revised volume estimate is found in Table 21.

- The waste piles and tailings remediation from the Basin Mill Site were removed from the Selected Remedy until EPA and the state can investigate and determine the scope of any reclamation that can be addressed under a state permit for the mill site. The remedy as ultimately designed and implemented will address any threats to the remedy and to human health and the environment posed by the Basin Mill site that are not adequately addressed through reclamation actions to be performed under a state permit(s). When it is known what, if any, reclamation will be accomplished under the state permit(s), the remedy will include and require all remedial actions determined appropriate to address contaminant sources that will not be addressed under the state permit(s), including, but not limited to, complete removal of all contaminated materials to the Luttrell Repository or other actions to prevent the migration of contaminants from the mill site from any waste materials left in place at the mill site.

- The cost estimate for the Selected Remedy was adjusted for the addition of waste from the WWTP area and the deletion of waste from the Basin Mill Site. In addition, revised costs were received from operations of Luttrell Repository.

- Institutional controls will only be necessary if wastes remain in inaccessible areas such as beneath residential structures and if risks associated with such mine waste are identified.

Section 15
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Appendix A
Responsiveness Summary

The proposed plan for the Town of Basin Operable Unit was issued for public comment on January 2, 2001. The public comment period occurred from January 2, 2001, through February 3, 2001. During the public comment period, EPA held one public meeting to discuss the proposed plan and receive comments on the Selected Remedy. In addition, EPA received one written comment on the proposed plan during the comment period. This document summarizes the questions and concerns received during the public comment period. The concerns have been grouped into several categories for ease of discussion. EPA's response to each comment follows in italics.

Roads/Bridges

Several residents expressed concerns over the road damage caused by past clean up activities conducted by EPA.

> *EPA intends to repair roads to their original condition subsequent to the cleanup activities. EPA will also maintain the roads during the cleanup action.*

Several residents are concerned that the bridge on the north end of town leading to the Luttrell Repository may not support typical hauling loads.

> *EPA will continue to evaluate the bridge condition and, if necessary, EPA (in consultation with the county) will make the appropriate upgrades/repairs to allow the bridge to meet the loading requirements.*

One resident questioned if EPA evaluated alternate haul routes in lieu of the route down Quartz Avenue, past the school.

> *EPA is continuing to evaluate alternate haul routes to the Luttrell Repository that would bypass Quartz Avenue and the Basin School. However, during the residential soil removal activities, the haul route through town will be required.*

Cleanup Criteria

Several comments were received concerning leaving some of the mine waste in source areas, specifically near the Wastewater Treatment Plant.

> *After review of the comments, EPA decided to modify the Selected Remedy to include excavation of all mine waste with contaminant concentrations above the cleanup levels. If all waste above health-based criteria cannot be removed due to inaccessibility (under structures), EPA will implement institutional controls such as deed notices or other appropriate mechanisms.*

There were several comments about EPA's ability to excavate all materials in the source areas.

> *EPA intends to excavate all materials with contaminant concentrations above the established cleanup level. EPA recognizes that excavations adjacent to the Boulder River will require special consideration. However, EPA intends to excavate all tailings near the Boulder River. All other source areas, including residential areas, will be cleaned to the remediation levels.*

Institutional Controls

There was one question concerning the types of institutional controls that would be considered for those areas that are remediated under this Record of Decision.

Because EPA has modified the Selected Remedy to include the excavation of all those materials with contaminant concentrations above the cleanup level, institutional controls would only be required if mine waste remains in inaccessible areas (i.e., adjacent to structures.) Institutional controls that may be used include deed restrictions, deed notices, and information dissemination.

Onsite Repository

One commentor questioned why EPA did not select the alternative that included the onsite repository. The commentor also suggested using the former silica mine near Basin as the preferred location for an onsite repository.

EPA determined that the cost to construct and operate/ maintain an onsite repository was more than the cost to haul the waste to the Luttrell Repository. In addition, the silica mine is not an appropriate location for a waste repository. The mine is located adjacent to the Boulder River and the existing steep slopes of the mine make it difficult to prepare as a repository.

Residential Response Activities

A resident questioned whether EPA was planning to replace items (fences, landscaping, etc.) that are removed/ damaged during the cleanup activities.

EPA will consult with the homeowner during the design preparation and before the cleanup action to discuss any concerns. EPA plans to return all residential properties to the original condition prior to the excavation activities.

Proposed Plan Support

A representative of the Montana Department of Environmental Quality commented that they have participated in the remedial activities and support the Selected Remedy.

Cost of Cleanup

One resident questioned the cost of the cleanup and whether the cost was justified.

EPA determined that there are current human health exposure risks associated with the mining activities conducted in the area. EPA believes that the waste material must be removed and that the Preferred Alternative as modified to the Selected Remedy provides the most cost effective solution.

Mine Sites

One commentor suggested that mine waste associated with the mining claims must be removed for security and safety issues.

EPA will evaluate mining claims areas in the watershed project.

Appendix B

Identification and Description of Applicable or Relevant and Appropriate Requirements

Identification and Description of Applicable or Relevant and Appropriate Requirements

Town of Basin Site
March 2001

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I. CONTAMINANT SPECIFIC ARARs

A. Federal and State Groundwater ARARs.

Groundwater ARARs must be met throughout the Town of Basin OU1 site.

1. Federal Requirements.

Safe Drinking Water Act, 42 U.S.C. § 300f, et seq., National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141 and 142 (relevant and appropriate).
The National Primary and Secondary Drinking Water Regulations (40 CFR Parts 141 and 143) establish maximum contaminant levels (MCLs) for chemicals in drinking water distributed in public water systems. These are enforceable in Montana under the Public Water Safety Act, MCA § 75-6-101, et seq., and ARM § 17.30.203. Safe Drinking Water Act MCLs are relevant and appropriate to a Town of Basin OU1 remedial action because the aquifers found beneath the Town of Basin OU1 are currently a source for public water supplies. These standards may be applicable in the future should EPA detect an exceedence at a public water outlet.

The determination that the drinking water standards are relevant and appropriate for portions of a Town of Basin OU1 remedial action is fully supported by the regulations and guidance. The Preamble to the National Contingency Plan (NCP) clearly states that the MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water. See 55 Fed. Reg. 8750, March 8, 1990, and 40 CFR § 300.430(e)(2)(I)(B). MCLs developed under the Safe Drinking Water Act generally are ARARs for current or potential drinking water sources. See, *EPA Guidance On Remedial Action For Contaminated Groundwater at Superfund Sites, OSWER Dir. #9283.1-2*, December 1988.

In addition, maximum contaminant level goals (MCLGs) may also be relevant and appropriate in certain site-specific situations. See 55 Fed. Reg. 8750-8752. MCLGs are health-based goals which are established at levels at which no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety. According to the NCP, MCLGs that are set at levels above zero must be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water. Where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant must be attained by the remedial actions.

The MCLs and MCLGs for the contaminants of potential concern are:

Contaminant	MCL (mg/L)	MCLGb (mg/L)
Antimony	0.006	0.006
Arsenic	0.05 a	NE
Cadmium	0.005 c	0.005
Copper	1.3 d	1.3
Iron	0.3 e	NE
Lead	0.015 d	0
Manganese	0.05 e	NE
Mercury	0.002 c	0
Thallium	0.002 c	0.0005
Zinc	5 e	NE

NE - Not Established

a 40 CFR § 141.11 - This standard was revised to 10 µg/L by regulation published at 66 FR 6976 (January 22, 2001). That regulation was to become effective on March 23, 2001. However, on March 20, 2001, EPA announced its proposal to withdraw the pending standard. A final decision on withdrawal is expected after a public comm ent period. On March 20, 2001, EPA also so ught a 60- day extension of the effective date of the pending standard. A new standard may be regarded as a relevant and appropriate ARAR if it has been promulgated, even though it may not yet be effective. To the extent the new standard has been “promulgated,” it should be regarded as the ARAR. However, if as a result of the review process the new standard is ultimately determined not to have been finally promulgated, it will not be deemed an ARAR for this action.

b 40 CFR § 141.51(b)
c 40 CFR § 141.62(c)
d 40 CFR § 141.80(c) - this is an action level, not a true MCL
e 40 CFR § 143.3 - secondary MCLS

2. **State of Montana Requirements**.

a. ARM § 17.30.1005 and -1006 (all applicable).
ARM § 17.30.1005 explains the applicability and basis for the groundwater standards in ARM § 17.30.1006, which establishes the maximum allowable changes in groundwater quality and may limit discharges to groundwater.

ARM § 17.30.1006 provides that groundwater is classified I through IV based on its present and future most beneficial uses, and states that groundwater is to be classified according to actual quality or use, whichever places the groundwater in a higher class. Class I is the highest quality class; class IV the lowest. Based upon its use as a public drinking water supply, groundwater throughout the entire Town of Basin OU1 is considered Class I groundwater.

ARM § 17.30.1006 sets the standards for the different classes of groundwater. Concentrations of dissolved substances in Class I or II groundwater may not exceed the human health standards listed in department Circular WQB-7. **1** These levels are listed below for the contaminants of potential concern. Levels that are more stringent than the MCL or MCLG identified in the federal portion of the ARARs are set out in boldface type.

Contaminant	WQB-7 Standard (µg/L) a
Antimony	6
Arsenic	20
Cadmium	5
Copper	1,300
Iron	NE b
Lead	**15**
Manganese	NE b
Mercury	**2**
Thallium	**2**
Zinc	**2,100**

NE - Not Established; Bold - Concentrations that are more stringent than the federal requirements.
a WQB-7 standards for metals and arsenic in groundwater are based on the dissolved portion of the sample (after filtration through a 0.45 µm membrane filter).
b Concentrations of iron and manganese must not reach values that interfere with the uses specified in the surface and groundwater standards (ARM § 17.30.601 et seq. and ARM § 17.30.1001 et seq.). The secondary maximum contaminant levels of 300 µg/L and 50 µg/L, respectively, may be considered guidance to determine levels that will interfere with the specified uses.

1 Montana Department of Environmental Quality, Water Quality Division, Circular WQB-7, Montana Numeric Water Quality Standards (September 1999).

ARM § 17.30.1006 requires that concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentrations of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification.

b. ARM § 17.30.1011 (applicable). This section provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality in accordance with MCA § 75-5-303.

An additional concern with respect to ARARs for groundwater is the impact of groundwater upon surface water. If significant loadings of contaminants from groundwater sources to Basin Creek and Boulder River contribute to the inability of the stream to meet A-1 and B-1 class standards, respectively, then alternatives to alleviate such groundwater loading must be evaluated and, if appropriate, implemented. Groundwater in certain areas may have to be remediated to levels more stringent than the groundwater classification standards in order to achieve the standards for affected surface water. See Compliance with Federal Water Quality Criteria, OSWER Publication 9234.2-09/FS (June 1990) ("Where the ground water flows naturally into the surface water, the groundwater remediation should be designed so that the receiving surface-water body will be able to meet any ambient water-quality standards (such as State Water Quality Standards [WQSs] or Federal Water Quality Criteria [FWQC]) that may be ARARs for the surface water.")

B. Federal and State Surface Water ARARs.

1. Federal Surface Water Quality Requirements, Clean Water Act, 33 U.S.C. §§ 1251, et seq. (applicable). As provided under Section 303 of the Clean Water Act, 33 U.S.C. § 1313, the State of Montana has promulgated water quality standards. See the discussion concerning State surface water quality requirements.

2. State of Montana Surface Water Quality Requirements, Montana Water Quality Act, MCA § 75-5-101, et seq., and implementing regulations (applicable). General. The Clean Water Act, 33 U.S.C. § 1251, et seq., provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. The Montana Water Quality Act, MCA § 75-5-101, et seq., establishes requirements for restoring and maintaining the quality of surface and groundwater. The State has the authority to adopt water quality standards designed to protect beneficial uses of each water body and to designate uses for each water body. Montana's regulations classify State waters according to quality, place restrictions on the discharge of pollutants to State waters, and prohibit degradation of State waters. Pursuant to this authority and the criteria established by Montana surface water quality regulations, ARM § 17.30.601, et seq., Montana has established the Water- Use Classification system. Under ARM § 17.30.610, tributaries to the Missouri River, including Boulder River have been classified "B-1". The Basin Creek drainage to the Basin water supply intake has been classified under the more restrictive "A-1" category. Ditches and certain other bodies of surface water must also meet these requirements. **2** Certain portions of the A-1 and B-1 standards, codified at ARM § 17.30.622 and ARM § 17.30.623, as well as Montana's nondegradation requirements, are presented below.

a. ARM § 17.30.622 (applicable). Waters classified A-1 are, after conventional treatment for removal of naturally present impurities, suitable for drinking, culinary and food processing purposes. These waters are also suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial purposes. This section provides also that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters which would remain in water after conventional water treatment may not exceed standards set forth in department circular WQB-7. WQB-7 provides that "whenever both Aquatic Life Standards and Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the numeric Surface Water Quality Standard." For the contaminants of potential concern the Circular WQB-7 standards are listed below.

2 As provided under ARM § 17.30.602(25), "'surface waters' means any waters on the earth's surface, including but not limited to, streams, lakes, ponds, and reservoirs; and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir or other surface water. Water bodies used solely for treating, trans porting or impounding pollutants shall not be considered surface water."

Contaminant	WQB-7 Standard (µg/L)
Antimony	6
Arsenic	18
Cadmium	5
Copper	5.2 b
Iron	1000 a
Lead	3.2 c
Manganese	NE a
Mercury	0.05
Thallium	1.7
Zinc	67 e

NE - Not Established
a Concentrations of iron and manganese must not reach values that interfere with the uses specified in the surface and groundwater standards (ARM § 17.30.601 et seq. and ARM § 17.30.1001 et seq.). The secondary maximum contaminant levels of 300 µg/L and 50 µg/L, respectively, may be considered guidance to determine levels that will interfere with the specified uses.
b Chronic Aquatic Life Standard based on 50 mg/L hardness.
c Chronic Aquatic Life Standard based on 100 mg/L hardness.
d Acute Aquatic Life Standard based on 100 mg/L hardness.
e Acute Aquatic Life Standard based on 50 mg/L hardness.

The A-1 classification standards at ARM § 17.30.622 also include the following criteria: 1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; 2) induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside of this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0; 3) no increase above naturally occurring turbidity is allowed except as permitted in ARM § 17.30.637; 4) temperature increases must be kept within prescribed limits; 5) no increases above naturally occurring concentrations of sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife are allowed; 5) True color must not be increased more than two units above naturally occurring color.

b. ARM § 17.30.623 (applicable). Waters classified B-1 are, after conventional treatment for removal of naturally present impurities, suitable for drinking, culinary and food processing purposes. These waters are also suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial purposes. This section provides also that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters which would remain in water after conventional water treatment may not exceed standards set forth in department circular WQB-7. WQB-7 provides that “whenever both Aquatic Life Standards and Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the numeric Surface Water Quality Standard.” These numerical standards for the contaminants of concern are the same as for waters classified A-1.

The B-1 classification standards at ARM § 17.30.623 also include the following criteria: (1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; (2) induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside of this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0; (3) the maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units except as permitted in ARM § 17.30.637; (4) temperature increases must be kept within prescribed limits; (5) no increases above naturally occurring concentrations of sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife are

allowed; and (6) true color must not be increased more than five units above naturally occurring color.

c. ARM § 17.30.637 (applicable). This provision provides that surface waters must be free of substances attributable to industrial practices or other discharges that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; (e) create conditions which produce undesirable aquatic life.

ARM § 17.30.637 also states that no waste may be discharged and no activities conducted which, either along or in combination with other waste activities, will cause violation of surface water quality standards; provided a short term exemption from a surface water quality standard may be authorized by the department under certain conditions. These conditions are listed in ARM § 17.30.637 (3).

d. ARM § 17.30.705 (applicable). Existing and anticipated uses of surface water and water quality necessary to support those uses must be maintained and protected.

C. Federal and State Air Quality ARARs.

1. National Ambient Air Quality Standards, 40 CFR § 50.6 (PM-10); 40 CFR § 50.12 (lead) (applicable). These provisions establish standards for PM-10 and lead emissions to air. (Corresponding state standards are found at ARM § 17.8.222 (lead) and ARM § 17.8.223 (PM-10).)

2. Montana Ambient Air Quality Regulations, ARM §§ 17.8.206, -. 222, -. 220, and -. 223 (applicable).

a. ARM § 17.8.206. This provision establishes sampling, data collection and analytical requirements to ensure compliance with ambient air quality standards.

b. ARM § 17.8.222. Lead emissions to ambient air shall not exceed a ninety (90) day average of 1.5 micrograms per cubic liter of air.

c. ARM § 17.8.220. Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

d. ARM § 17.8.223. PM- 10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

II. LOCATION SPECIFIC REQUIREMENTS

The statutes and regulations set forth below relate to solid waste, floodplains, floodways, streambeds, and the preservation of certain cultural, historic, natural or other national resources located in certain areas which may be adversely affected by potential Town of Basin OU1 remedial actions.

A. National Historic Preservation Act, 16 U.S.C. § 470, 40 CFR § 6.301(b), 36 CFR Part 800 (NHPA) (applicable). This statute and implementing regulations require Federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the Register of Historic Places. Compliance with NHPA requirements will be attained through agreements entered into with EPA, the State of Montana, and the Town of Basin during the

implementation of a remedial action.

B. Archaeological and Historic Preservation Act, 16 U.S.C. § 469, 40 CFR 6.301(c) (applicable). This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a Federal construction project or a federally licensed activity or program. This requires EPA or potentially responsible parties (PRPs) to survey the site for covered scientific, prehistorical or archaeological artifacts. The results of this survey will be reflected in the Administrative Record. Preservation of appropriate data concerning the artifacts is hereby identified as an ARAR requirement, to be completed during the implementation of a remedial action.

C. Historic Sites, Buildings and Antiquities Act, 16 U.S.C. § 461, et seq., 40 CFR § 6.310(a) (applicable). This statute and implementing regulations require federal agencies to consider the existence and location of land marks on the National Registry of National Landmarks and to avoid undesirable impacts on such landmarks.

D. Fish and Wildlife Coordination Act, 16 U.S.C. §§ 1531, et seq., 40 CFR § 6.302(g) (applicable). This statute and implementing regulations require that Federal agencies or federally funded projects ensure that any modification of any stream or other water body affected by any action authorized or funded by the Federal agency provides for adequate protection of fish and wildlife resources. Compliance with this ARAR requires EPA to consult with the U. S. Fish and Wildlife Service (USFWS) and the Montana Department of Fish, Wildlife, and Parks. Further consultation will occur during remedial design and remedial action.

E. Endangered Species Act, 16 U.S.C. § 1531, 40 CFR § 6.302(h), 50 CFR Parts 17 and 402 (applicable). This statute and implementing regulations provide that federal activities not jeopardize the continued existence of any threatened or endangered species. The remedy selection process, including the Feasibility Study, should identify whether the proposed remedial actions will impact threatened and/ or endangered species and/or their habitat, and what avoidance or mitigative measures are necessary.

F. Floodplain Management Regulations, 40 CFR § 6.302(b), and Executive Order No. 11988 (applicable). These require that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists.

G. Protection of Wetlands Regulations, 40 CFR Part 6, Appendix A, and Executive Order No. 11990 (applicable). This ARAR requires Federal agencies and the PRPs to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Wetlands are defined as those areas that are inundated or saturated by groundwater or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Compliance with this ARAR will be achieved through consultation with the USFWS and the U. S. Army Corps of Engineers (USACE), to determine the existence and category of wetlands present at the site, and any avoidance or mitigation and replacement which may be necessary.

H. Migratory Bird Treaty Act, 16 U.S.C. §§ 703, et seq. (applicable). This requirement establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement.

I. Bald Eagle Protection Act, 16 U. S. C. §§ 668, et seq. (applicable). This requirement establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial

construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagles. Specific mitigative measures may be identified for compliance with this requirement

J. Resource Conservation and Recovery Act and regulations, 40 CFR § 264.18 (a) and (b)(relevant and appropriate). Regulations promulgated under the Solid Waste Management, MCA § 75-10-201, et seq., specify requirements that apply to the location of any solid waste management facility.

K. Native American Graves Protection and Repatriation Act, 25 U.S.C. § 3001, et seq. (applicable). The Act prioritizes ownership or control over Native American cultural items, including human remains, funerary objects and sacred objects, excavated or discovered on Federal or tribal lands. Federal agencies and museums that have possession or control over Native American human remains and associated funerary objects are required under the Act to compile an inventory of such items and, to the extent possible, identify their geographical and cultural affiliation. Once the cultural affiliation of such objects is established, the Federal agency or museum must expeditiously return such items, upon request by a lineal descendent of the individual Native American or tribe identified.

L. Montana Floodplain and Floodway Management Act and Regulations, MCA § 76-5-401, et seq., ARM § 36.15.601, et seq. (applicable). The Floodplain and Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100- year floodway **3** and floodplain. **4** Since the Town of Basin OU1 may lie partially within the 100-year floodplain of Basin Creek and Boulder River, these standards are applicable to all actions within these floodplain areas.

i. **Allowed uses**. The law recognizes certain uses as allowable in the floodway and a broader range of uses as allowed in the floodplain. Residential use is among the possible allowed uses expressly recognized in both the floodway and floodplain. “Residential uses such as lawns, gardens, parking areas, and play areas,” as well as certain agricultural, industrial- commercial, recreational and other uses are permissible within the designated floodway, provided they do not require structures other than portable structures, fill or permanent storage of materials or equipment. MCA § 76-5-401; ARM § 36.15.601 (Applicable). In addition, in the flood fringe (i.e., within the floodplain but outside the floodway), residential, commercial, industrial, and other structures may be permitted subject to certain conditions relating to placement of fill, roads, floodproofing, etc. MCA § 76-5-402; ARM § 36.15.701 (Applicable). Domestic water supply wells may be permitted, even within the floodway, provided the well casing is watertight to a depth of 25 feet and the well meets certain conditions for floodproofing, sealing, and positive drainage away from the well head. ARM § 36.15.602(6).

3 The "floodway" is the channel of a watercourse or drainway and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge the floodwater of the watercourse or drainway. ARM § 36.15.101(13).

4 The "floodplain" is the area adjoining the watercourse or drainway which would be covered by the floodwater of a base (100-year) flood except for sheetflood areas that receive less than one foot of water per occurrence. The floodplain consists of the floodway and flood fringe.

ii. **Prohibited uses**. Uses prohibited anywhere in either the floodway or the floodplain are:

- solid and hazardous waste disposal; and
- storage of toxic, flammable, hazardous, or explosive materials.

ARM §§ 36.15.605(2) and 36.15.703 (Applicable); see also ARM § 36.15.602(5)(b) (Applicable).

In the floodway, additional prohibitions apply, including prohibition of:

- a building for living purposes or place of assembly or permanent use by human beings;
- any structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway; and
- the construction or permanent storage of an object subject to flotation or movement during flood level periods.

MCA § 76-5-402 (Applicable).

3. Applicable considerations in use of floodplain or floodway. Applicable regulations also specify factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway. Many of these requirements are set forth as factors that must be considered in determining whether a permit can be issued for certain obstructions or uses. While permit requirements are not directly applicable to remedial actions conducted entirely on site, the substantive criteria used to determine whether a proposed obstruction or use is permissible within the floodway or floodplain are applicable standards. Factors which must be considered in addressing any obstruction or use within the floodway or floodplain include:

- the danger to life and property from backwater or diverted flow caused by the obstruction or use;
- the danger that the obstruction or use will be swept downstream to the injury of others;
- the availability of alternate locations;
- the construction or alteration of the obstruction or use in such a manner as to lessen the danger;
- the permanence of the obstruction or use; and
- the anticipated development in the foreseeable future of the area which may be affected by the obstruction or use.

See MCA § 76-5-406; ARM § 36.15.216 (Applicable, substantive provisions only). Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

- the proposed activity, construction, or use cannot increase the upstream elevation of the 100- year flood a significant amount (½ foot or as otherwise determined by the permit issuing authority) or significantly increase flood velocities, ARM § 36.15.604 (Applicable, substantive

provisions only); and

- the proposed activity, construction, or use must be designed and constructed to minimize potential erosion.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

Excavation of material from pits or pools - ARM § 36.15.602(1).

Water diversions or changes in place of diversion - ARM § 36.15.603.

Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) - ARM § 36.15.606.

Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights) - ARM § 36.15.701(3)(c).

Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with Montana Department of Environmental Quality (MDEQ) regulations, which include certain additional prohibitions on such disposal) - ARM § 36.15.701(3)(d).

Residential structures -ARM § 36.15.702(1).

Commercial or industrial structures - ARM § 36.15.702(2).

M. Montana Natural Streambed and Land Preservation Act and Regulations, MCA § 75-7-101 et seq. and ARM §§ 36.2.401 et seq. (applicable). Applicable if the remedial action alters or affects a streambed or its banks. The adverse effects of any such action must be minimized.

ARM 36.2.410 (Applicable) establishes minimum standards which would be applicable if a response action alters or affects a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. Projects must be designed and constructed using methods that minimize adverse impacts to the stream (both upstream and downstream) and future disturbances to the stream. All disturbed areas must be managed during construction and reclaimed after construction to minimize erosion. Temporary structures used during construction must be designed to handle high flows reasonably anticipated during the construction period. Temporary structures must be completely removed from the stream channel at the conclusion of construction, and the area must be restored to a natural or stable condition. Channel alterations must be designed to retain original stream length or otherwise provide hydrologic stability. Streambank vegetation must be protected except where removal of such vegetation is necessary for the completion of the project. When removal of vegetation is necessary, it must be kept to a minimum. Riprap, rock, and other material used in a project must be of adequate size, shape, and density and must be properly placed to protect the streambank from erosion. The placement of road fill material in a stream, the placement of debris or other materials in a stream where it can erode or float into the stream, projects that permanently prevent fish migration, operation of construction equipment in a stream, and excavation of streambed gravels are prohibited unless specifically authorized by the district. Such projects must also protect the use of water for any useful or beneficial purpose. See § 75-7-102, MCA.

While the administrative/procedural requirements, including the consent and approval requirements, set forth in these statutes and regulations are not ARARs, the party designing and implementing the response action is encouraged to continue to consult with the Montana Department of Fish, Wildlife and Parks and any conservation district or board of county commissioners (or consolidated city/ county government) as provided in the referenced statutes, to assist in the evaluation of factors discussed above.

N. Montana Solid Waste Management Act and regulations, MCA § 75-10-201, et seq., ARM § 17.50.505 (applicable). Sets forth requirements applying to the location of any solid waste management facility. Among other things, the location must have sufficient acreage, must not be within a 100-year floodplain, must be located so as to prevent pollution of ground, surface, and private and public water supply systems, and must allow for reclamation of the land.

III. ACTION SPECIFIC REQUIREMENTS

A. Federal and State Water Requirements.

1. Clean Water Act Point Source Discharges requirements, 33 U.S.C. § 1342 (applicable). Section 402 of the Clean Water Act, 33 U.S.C. § 1342, et seq., authorizes the issuance of permits for the "discharge" of any "pollutant." This includes storm water discharges associated with "industrial activity." See, 40 CFR § 122.1(b)(2)(iv). "Industrial activity includes inactive mining operations that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations, see, 40 CFR § 122.26(b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under RCRA Subtitle D, see, 40 CFR § 122.26(b)(14)(v); and construction activity including clearing, grading, and excavation activities, see, 40 CFR § 122.26(b)(14)(x). Because the State of Montana has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES). The MPDES requirements are set forth below.

a. Substantive MPDES Permit Requirements, ARM §§ 17.30.1342-1344 (applicable). These set forth the substantive requirements applicable to all MPDES and National Pollutant Discharge Elimination System (NPDES) permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and control are applicable requirements.

b. Technology-Based Treatment, ARM §§ 17.30.1203 and 1344 (applicable). Provisions of 40 CFR Part 125 for criteria and standards for the imposition of technology-based treatment requirements are adopted and incorporated in MDEQ permits. Although the permit requirement would not apply to on- site discharges, the substantive requirements of Part 125 are applicable, i.e., for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

2. Additional State of Montana requirements.

a. Water Quality Statute and Regulations (all applicable).

i. Causing of Pollution, MCA § 75-5-605. This section of the Montana Water Quality Act prohibits the causing of pollution of any state waters. Pollution is defined as contamination or other alteration of physical, chemical, or biological properties of state waters which exceeds that permitted by the water quality standards. Also, it is unlawful to place or caused to be placed any wastes where they will cause pollution of any state waters. Any permitted placement of waste is not placement if the agency's permitting authority contains provisions for review of the placement of materials to ensure it will not cause pollution to state waters.

ii. Nondegradation, MCA § 75-5-303. This provision states that existing uses of state waters and the level of water quality necessary to protect the uses

must be maintained and protected. Section MCA § 75- 5- 317 provides an exemption from nondegradation requirements which allows changes of existing water quality resulting from an emergency or remedial activity that is designed to protect the public health or the environment and that is approved, authorized, or required by the department. Degradation meeting these requirements may be considered nonsignificant. In determining that remedial actions are protective of public health and the environment and in approving, authorizing, or requiring such remedial activities, no significant degradation should be approved.

(a) ARM § 17.30.705. This provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM § 17.30.708.

(b) ARM § 17.30.1011. This provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless degradation may be allowed under the principles established in MCA § 75-5-303, and the nondegradation rules at ARM § 17.30.701, et seq.

iii. Stormwater Runoff.

(a) ARM § 17.24.633. All surface drainage from a disturbed area must be treated by the best technology currently available.

(b) General Permits. Under ARM § 17.30.601, et seq., and ARM § 17.30.1301, et seq., including ARM § 17.30.1332, the Water Quality Division has issued general storm water permits for certain activities. The substantive requirements of the following permits are applicable for the following activities: (1) for construction activities: General Discharge Permit for Storm Water Associated with Construction Activity, Permit No. MTR100000 (May 19, 1997); (2) for mining activities: General Discharge Permit for Storm Water Associated with Mining and with Oil and Gas Activities, Permit No. MTR300000 (September 10, 1997). **5** (3) for industrial activities: General Discharge Permit for Storm Water Associated with Industrial Activity, Permit No. MTR000000 (October 26, 1994). **6**

Generally, the permits require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, an individual MPDES permit or alternative general permit may be required.

iv. Surface Water, ARM § 17.30.637. Prohibits discharges containing substances that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; or (e) create conditions which produce undesirable aquatic life.

5 This permit covers point source discharges of storm water from mining and milling activities (including active, inactive, and abandoned mine and mill sites) including activities with Standard Industrial Code 14 (metal mining).

6 Industrial activities are defined as all industries defined in 40 C FR §§ 122, 123, and 124, excluding construction , mining , oil & gas extraction activities and storm water discharges subject to effluent limitations guidelines. This includes wood treatment operations, as well as the production of slag.

B. Federal and State RCRA Subtitle C Requirements, 42 U.S.C. Section 6921, et seq. (relevant and appropriate for solid wastes, applicable for hazardous wastes). The presentation of RCRA Subtitle C requirements in this section assumes that there will be many solid wastes at the Town of Basin OU1, and that some of these may be left in place in "waste management areas" as a result of a remedial action. Because of the similarity of these waste management areas to the RCRA "waste management unit," certain discrete portions of the RCRA Subtitle C implementing regulations will be relevant and appropriate for the Town of Basin OU1 remedial action. RCRA Subtitle C and implementing regulations are designated as applicable for any hazardous wastes that are actively "generated" as part of the Town of Basin OU1 remedial action or that were "placed" or "disposed" after 1980. Also, should hazardous wastes be discovered as part of any remedial design or remedial action, EPA reserves the right to identify RCRA Subtitle C requirements in more detail at a later date. All federal RCRA Subtitle C requirements set forth below are incorporated by reference as State of Montana requirements as provided for under ARM § 17.54.112(6) unless mentioned otherwise below.

1. 40 CFR Part 264 Subpart F. General Facility Standards. This is potentially relevant and appropriate for solid wastes at this OU. Any waste management unit or similar area would be required to comply with the following requirements.

a. 40 CFR § 264.92,.93. and .94. Prescribes groundwater protection standards.

b. 40 CFR § 264.97. Prescribes general groundwater monitoring requirements.

c. 40 CFR § 264.98. Prescribes requirements for monitoring and detecting indicator parameters.

2. Closure requirements.

a. 40 CFR § 264.111. This provides that the owner or operator of a hazardous waste management facility must close the facility in a way that minimizes the need for further maintenance, and controls or eliminates the leaching or escape of hazardous waste or its constituents, leachate, or runoff to the extent necessary to protect human health and the environment.

b. 40 CFR § 264.117. This provision incorporates monitoring requirements in Part 264, including those mentioned at Part 264.97 and Part 264.303. It governs the length of the post-closure care period, permits a lengthened security period, and prohibits any use of the property which would disturb the integrity of the management facility.

c. 40 CFR § 264.310. This specifies requirements for caps, maintenance, and monitoring after closure.

d. 40 CFR § 264.301. Prescribes design and operating requirements for landfills.

e. 40 CFR § 264.301(a). This provides for a single liner and leachate collection and removal system.

f. 40 CFR § 264.301(f). This requires a run-on control system.

g. 40 CFR § 264.301(g). This requires a run-off management system.

h. 40 CFR § 264.301(h). This requires prudent management of facilities for collection and holding of run-on and run-off.

i. 40 CFR § 264.301(i). This requires that wind dispersal of particulate matter be controlled.

C. Federal and State RCRA Subtitle D and Solid Waste Requirements (applicable). 40 CFR Part 257 establishes criteria under Subtitle D of the Resource Conservation and Recovery Act for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment. See 40 CFR § 257.1(a). This part comes into play whenever there is a "disposal" of any solid or hazardous waste from a "facility." "Disposal" is defined as "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters." See 40 CFR § 257.2. "Facility" means "any land and appurtenances thereto used for the disposal of solid wastes." Solid waste requirements are listed herein because mine wastes to be addressed in the remedial action are considered solid waste.

1. Federal Requirements - 40 CFR § 257. Criteria for Classification of Solid Waste Disposal Facilities and Practices. The activities to be performed for the Town of Basin OU1 remedial action are expected to comply with the following requirements.

a. 40 CFR § 257.3-1. Washout of solid waste in facilities in a floodplain posing a hazard to human life, wildlife, or land or water resources shall not occur.

b. 40 CFR § 257.3-2. Facilities shall not contribute to the taking of endangered species or the endangering of critical habitat of endangered species.

c. 40 CFR § 257.3-3. A facility shall not cause a discharge of pollutants, dredged or fill material, into waters of the United States in violation of Sections 402 and 404 of the Clean Water Act, as amended, and shall not cause non-point source pollution, in violation of applicable legal requirements implementing an area wide or statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended.

d. 40 CFR § 257.3-4. A facility shall not contaminate an underground source of drinking water beyond the solid waste boundary or beyond an alternative boundary specified in accordance with this section.

e. 40 CFR § 257.3-8(d). Access to a facility shall be controlled so as to prevent exposure of the public to potential health and safety hazards at the site.

2. State of Montana Solid Waste Requirements (applicable). The Montana Solid Waste Management Act § 75-10-201 et seq., MCA, and regulations are applicable to the management and disposal of all solid wastes, including mine wastes at sites that are not currently subject to operating permit requirements.

a. ARM § 17.50.505(1) and (2). Sets forth standards that all solid waste disposal sites must meet, including the requirements that (1) Class II landfills must confine solid waste and leachate to the disposal facility. If there is the potential for leachate migration, it must be demonstrated that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters; (2) adequate separation of group II wastes from underlying or adjacent water must be provided; and (3) no new disposal units or lateral expansions may be located in wetlands. ARM § 17.50.505 also specifies general soil and hydrogeological requirements pertaining to the location of any solid waste management facility.

b. ARM § 17.50.506. Specifies design requirements for landfills. Landfills must either be designed to ensure that MCLS are not exceeded or the landfill must contain a composite liner and leachate collection system which comply with specified

criteria.

c. ARM § 17.50.510. Sets forth general operational and maintenance and design requirements for solid waste facilities using land filling methods. Specific operational and maintenance requirements specified in ARM § 17.50.510 that are applicable are run-on and run-off control systems requirements, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements.

d. MCA § 75-10-212 and ARM § 17. 50.523. For solid wastes, MCA § 75-10-212 prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted. ARM § 17.50.523 specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

e. MCA § 75-10-206. Provides for a variance from certain solid waste requirements where such variance would not result in a danger to public health or safety. Certain of the solid waste regulations regarding design of landfills, ARM 17.50.506, operational and maintenance requirements, ARM 17.50.510, and landfill closure requirements and post-closure care, ARM 17. 50.530-531 may be subject to variance, if the requirements of § 75-10-206, MCA, are met.

f. ARM § 17.50.530. Sets forth the closure requirements for landfills. Class II landfills must meet the following criteria: (1) install a final cover that is designed to minimize infiltration and erosion; (2) design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less; (3) minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth and protecting the infiltration layer from frost effects and rooting damage; (4) revegetate the final cover with native plant growth within one year of placement of the final cover.

g. ARM § 17.50.531. Sets forth post closure care requirements for Class II landfills. Post closure care must be conducted for a period sufficient to protect human health and the environment. Post closure care requires maintenance of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 17, Chapter 50, Subchapter 7.

D. Surface Mining Control and Reclamation Act, 30 U.S.C. §§ 1201-1326 (relevant and appropriate). This Act and implementing regulations found at 30 CFR Parts 784 and 816 establish provisions designed to protect the environment from the effects of surface coal mining operations, and to a lesser extent non- coal mining. These requirements are relevant and appropriate to the covering of discrete areas of contamination. The regulations require that revegetation be used to stabilize soil covers over reclaimed areas. They also require that revegetation be done according to a plan which specifies schedules, species which are diverse and effective, planting methods, mulching techniques, irrigation if appropriate, and appropriate soil testing. Reclamation performance standards are currently relevant and appropriate to mining waste sites.

E. Montana Strip and Underground Mine Reclamation Act, MCA § 82-4-201, et seq., (all relevant and appropriate) and Montana Metal Mining Reclamation Act, MCA § 82-4-301, et seq., (relevant and appropriate). Certain portions of the following statutory or regulatory provisions, as identified below, are relevant and appropriate requirements.

1. MCA § 82-4-231. Requires operators to reclaim and revegetate affected lands using most modern technology available. Operators must grade, backfill, topsoil, reduce high walls, stabilize subsidence, control water, minimize erosion, subsidence, land slides, and water pollution.

2. MCA § 82-4-233. Operators must plant vegetation that will yield a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration.

3. MCA § 82-4-336. (Montana Metal Mine Reclamation Act). Disturbed areas must be reclaimed to utility and stability comparable to areas adjacent.

4. ARM § 17.24.501. Provides general backfilling and grading requirements. Backfill must be placed so as to minimize sedimentation, erosion, and leaching of acid or toxic materials into waters, unless otherwise approved. Final grading must be to the approximate original contour of the land and final slopes must be graded to prevent slope failure, may not exceed the angle of repose, and must achieve a minimum long-term static safety factor of 1:3. The disturbed area must be blended with surrounding and undisturbed ground to provide a smooth transition in topography.

5. ARM § 17.24.519. Requires monitoring of settling of regraded areas, and potential modification of reclamation, spoiling, and grading techniques to alleviate uneven settling problems. Pertinent areas of the Town of Basin OU1 where excavation will occur will be regraded to minimize settlement.

6. ARM § 17.24.631 (1),(2),(3)(a), and (b). Disturbances to the prevailing hydrologic balance will be minimized. Changes in water quality and quantity, in the depth to groundwater, and in the location of surface water drainage channels will be minimized, to the extent consistent with the selected response alternatives. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid- forming and toxic- forming waste materials.

7. ARM § 17.24.633. Surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

8. ARM § 17.24.634. Disturbed drainages will be restored to the approximate predisturbance configuration, to the extent consistent with the selected response alternatives. Drainage design must emphasize channel and floodplain dimensions that approximate the premining configuration and that will blend with the undisturbed drainage above and below the area to be reclaimed. The average stream gradient must be maintained with a concave longitudinal profile. This regulation provides specific requirements for designing the reclaimed drainage to: (1) meander naturally; (2) remain in dynamic equilibrium with the system; (3) improve unstable premining conditions; (4) provide for floods; and (5) establish a premining diversity of aquatic habitats and riparian vegetation.

9. ARM § 17.24.638. Sediment control measures must be implemented during operations.

10. ARM § 17.24.639. Sets forth requirements for construction and maintenance of sedimentation ponds.

11. ARM § 17.24.640. Discharges from sedimentation ponds, permanent and temporary impoundments, must be controlled to reduce erosion, prevent deepening or enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

12. ARM § 17.24.641. Practices to prevent drainage from acid or toxic forming spoil material into ground and surface water will be employed.

13. ARM §§ 17.24.643 through 17.24.646. Provisions for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.

14. ARM §§ 17.24.701 and 702. Requirements for redistributing and stockpiling of soil for reclamation. Also, practices to prevent compaction, slippage, erosion, and deterioration of biological properties of soil will be employed.

15. ARM § 17.24.703. When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use, and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM § 17.24.701 and 702.

16. ARM § 17.24.711. Requires that a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected must be established. This provision would not be relevant and appropriate in certain instances, for example, where there is dedicated development.

17. ARM § 17.24.713. Seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed preparation.

18. ARM § 17.24.714. Mulch or cover crop or both must be used until adequate permanent cover can be established.

19. ARM § 17.24.716. Establishes method of revegetation.

20. ARM § 17.24.717. Relates to the planting of trees and other woody species if necessary, as provided in § 82-4-233, MCA, to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the affected area and capable of self-regeneration and plant succession at least equal to the natural vegetation of the area, except that introduced species may be used in the revegetation process where desirable and necessary to achieve the approved land use plan.

21. ARM § 17.24.718. Requires soil amendments, irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.

22. ARM § 17.24.721. Specifies that rills or gullies in reclaimed areas must be filled, graded or otherwise stabilized and the area reseeded or replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover or causing or contributing to a violation of water quality standards for a receiving stream.

23. ARM § 17.24.723. States that operators shall conduct approved periodic measurements of vegetation, soils, water, and wildlife during the period of liability.

24. ARM § 17.24.724. Specifies that revegetation success must be measured against approved unmined reference areas or by comparison with technical standards from historic data. More than one reference area or historic record must be established for vegetation types with significant variation due to a number of factors. Required management for these reference areas is set forth.

25. ARM § 17.24.726. Requires standard and consistent field and laboratory methods to obtain vegetation production, cover, diversity, density, and utility data, and sets out the required methods for measuring and documenting productivity.

26. ARM § 17.24.728. Sets performance standards for native species and introduced species in revegetated areas.

27. ARM §§ 17.24.730 and 17.24.731. Provide that the revegetated area must furnish palatable forage in comparable quantity and quality during the same grazing period as the reference area or as compared to a technical standard derived from historic records. If toxicity to plants or animals on the revegetated area or the reference area is suspected due to the effects of the disturbance, comparative chemical analyses may be required.

28. ARM § 17.24.733. Provides performance standards for composition and stocking of trees, shrubs, and half- shrubs on the revegetated area and for measurement of revegetation success.

29. ARM § 17.24.751. Measures to protect and enhance fish and wildlife habitat will be employed.

30. ARM § 17.24.761. This specifies fugitive dust control measures which will be employed during excavation and construction activities to minimize the emission of fugitive dust in the Town of Basin OU1.

31. ARM § 17.24.824. If land use is to be other than grazing land or fish and wildlife habitat, areas of land affected by mining must be restored in a timely manner to higher or better uses achievable under criteria and procedures set forth.

F. Air Quality Requirements (all applicable). Remedial activities will comply with the following requirements to ensure that existing air quality will not be adversely affected by a Town of Basin OU1 remedial action.

1. ARM § 17.8.220. Settled particulate matter shall not exceed a 30 day average of 10 grams per square meter.

2. ARM § 17.8.222. The concentration of lead in ambient air shall not exceed a 90 day average of 1.5 micrograms per cubic meter of air.

3. ARM § 17.8.223. The concentration of PM- 10 in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

4. ARM § 17.8.308. Airborne particulate matter. There shall be no production, handling, transportation, or storage of any material, use of any street, road, or parking lot, or operation of a construction site or demolition project unless reasonable precautions are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 consecutive minutes.

5. ARM § 17.8.304(2). Visible Air Contaminants. Emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over six consecutive minutes.

6. ARM § 17.8.315(1). Nuisance or odor bearing gases. Gases, vapors and dusts will be controlled such that no public nuisance is caused within the Town of Basin OU1.

7. ARM § 17.24.761(2)(a), (e), (h), (j), and (k). Fugitive dust control measures such as 1) watering, stabilization, or paving of roads, 2) vehicle speed restrictions, 3) stabilization of surface areas adjoining roads, 4) restriction of travel on other than authorized roads, 5) enclosing, covering, watering, or otherwise treating loaded haul truck, 6) minimizing area of disturbed land, and 7) revegetation, must be planned and implemented, if any such measure or measures are appropriate for a remedial action.

G. Noxious Weeds, MCA § 7-22-2101(7)(a) and ARM § 4. 5.201, et seq. MCA § 7-22-2101(7)(a) defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department; or (ii) as a district noxious weed by a board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM § 4.5.201 through 4.5.204 and must be managed consistent with weed management criteria developed under MCA § 7-22-2109(2)(b).

IV. TO BE CONSIDERED DOCUMENTS (TBCs).

A list of TBC documents is included in the Preamble to the NCP, 55 Fed. Reg. 8765 (March 8, 1990). Those documents, plus any additional similar or related documents issued since that time, were considered by EPA and MDEQ during the conduct of the remedial investigation (RI)/feasibility study (FS), and will be further considered during remedy selection and during remedy implementation.

V. OTHER LAWS (NON-EXCLUSIVE LIST).

CERCLA defines as ARARs only federal environmental and state environmental and siting laws. Remedial design, implementation, and operation and maintenance must nevertheless comply with all other applicable laws, both state and federal, if the remediation work is done by parties other than the federal government or its contractors.

The following "other laws" are included here to provide a reminder of other legally applicable requirements for actions being conducted at the Town of Basin OU1 site. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not "environmental or facility siting laws." As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

Section 121(e) of CERCLA exempts removal or remedial actions conducted entirely on-site from federal, state, or local permits. This exemption is not limited to environmental or facility siting laws, but applies to other permit requirements as well.

A. Other Federal Laws.

1. Occupational Safety and Health Regulations. The federal Occupational Safety and Health Act regulations found at 29 CFR § 1910 are applicable to worker protection during conduct of RI/FS or remedial activities.

B. Other State Laws.

1. Groundwater Act. MCA § 85-2-505, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

2. Public Water Supply Regulations. If a remedial action at the site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM § 17.38.101(3) must be observed.

3. Groundwater Act. MCA § 85-2-516 states that within 60 days after any well is completed a well log report must be filed by the driller with the Montana Department of Natural Resources and Conservation (DNRC) and the appropriate county clerk and recorder.

4. Water Rights. MCA § 85-2-101 declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation

of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

MCA § 85-2-301 provides that a person may only appropriate water for a beneficial use.

MCA § 85-2-302 specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefor except by applying for and receiving a permit from the Montana DNRC. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system.

MCA § 85-2-306 specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

MCA § 85-2-311 specifies the criteria which must be met in order to appropriate water and includes requirements that:

- there are unappropriated waters in the source of supply;
- the proposed use of water is a beneficial use; and
- the proposed use will not interfere unreasonably with other planned uses or developments.

MCA § 85-2-402 specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the Montana DNRC.

MCA § 85-2-412 provides that where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

5. Occupational Health Act, MCA § 50-70-101, et seq. ARM § 17.74.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.95 applies.

ARM § 17.74.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation.

This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910. 1000 applies.

6. Montana Safety Act. MCA §§ 50-71-201, 202 and 203 state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

7. Employee and Community Hazardous Chemical Information Act. MCA §§ 50-78-201, 202, and 204 state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

Appendix C

Selected Remedy
Cost Estimate Spreadsheets

TABLE CS-4

Alternative 4
REMOVAL/TRANSPORTATION/DISPOSAL-LUTTRELL REPOSITORY/INSTITUTIONAL CONTROLS

COST ESTIMATE SUMMARY

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 2000
Date: February 13, 2001

Descriptic: Alternative 4 involves the excavation of the contaminated residential soils above PRGs in the town of Basin and disposal of these soils Excavations will be backfilled with fill and growth media, and revegetated (assumed sodding). Mine waste will also be excavated in the of at the Luttrell Repository. Mine waste excavations will be backfilled with fill and growth media, and revegetated (assumed hydroseed consisting of proprietary controls will be placed at sites where waste is left in-place. Annual O&M costs include mainte Periodic costs include Five-Year Review reports that document site conditions and effectiveness of this alternative.

CAPITAL COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Mobilization	CW-17	1	LS	$2,200	$2,200	
Miscellaneous Requirements	CW-18	1	LS	$103,267	$103,267	
Temporary Access Roads for Waste Excavation	CW-6	1	LS	$42,147	$42,147	
Alternate Access Road to Luttrell Repository	CW-1	1	LS	$52,891	$52,891	
Residential Soil Removal and Disposal (Luttrell Repository)	CW-7	1	LS	$198,556	$198,556	
Backfilling and Sodding Residential Excavations	CW-7	1	LS	$187,828	$187,828	
Mine Waste Removal and Disposal (Luttrell Repository)	CW-7	1	LS	$1,218,834	$1,218,834	
Backfilling and Revegetating Mine Waste Excavations	CW-8	1	LS	$708,382	$708,382	
Demobilization	CW-17	1	LS	$2,200	$2,200	
SUBTOTAL					$2,516,305	
Contingency (Scope and Bid)		25%			$629,076	10% Scope, 15% Bid (Low/mid range of recommended values).
SUBTOTAL					$3,145,381	
Project Management		5%			$157,269	Percentage from Exhibit 5-8 was used
Remedial Design		8%			$251,630	Percentage from Exhibit 5-8 was used
Construction Management		6%			$188,723	Percentage from Exhibit 5-8 was used
Proprietary Controls for Residential Areas	NA	28	EA	$400	$11,200	EPA cost, assumes 4 hours per property, $100/hour legal fees.
Proprietary Controls for Mine Waste Areas	NA	6	EA	$400	$2,400	EPA cost, assumes 4 hours per property, $100/hour legal fees.
Public Meeting	NA	1	LS	$1,000	$1,000	EPA cost for one public meeting during construction.
TOTAL					$3,757,603	
TOTAL CAPITAL COST					$3,757,600	

ANNUAL O&M COSTS (EPA):

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Luttrell Repository Maintenance for Years 1-10	NA	1	LS	$8,250	$8,250	EPA cost, per year.
SUBTOTAL					$8,250	No professional/technical services added; this is EPA cost.
Contingency (Scope and Bid)		25%			$2,063	10% Scope, 15% Bid (Low/mid range of recommended values).
TOTAL					$10,313	
TOTAL ANNUAL LUTTRELL REPOSITORY MAINTENANCE O&M COST FOR YEARS 1-10 (EPA)					$10,300	

TABLE CS-4

Alternative 4
REMOVAL/TRANSPORTATION/DISPOSAL-LUTTRELL REPOSITORY/INSTITUTIONAL CONTROLS

COST ESTIMATE SUMMARY

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 2000
Date: February 13, 2001

Descriptic: Alternative 4 involves the excavation of the contaminated residential soils above PRGs in the town of Basin and disposal of these soils Excavations will be backfilled with fill and growth media, and revegetated (assumed sodding). Mine waste will also be excavated in the of at the Luttrell Repository. Mine waste excavations will be backfilled with fill and growth media, and revegetated (assumed hydroseed consisting of proprietary controls will be placed at sites where waste is left in-place. Annual O&M costs include maint Periodic costs include Five-Year Review reports that document site conditions and effectiveness of this alternative.

ANNUAL O&M COSTS (STATE OF MONTANA):

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Luttrell Repository Maintenance for Years 11-30	NA	1	LS	$1,210	$1,210	State of Montana cost, per year.
SUBTOTAL					$1,210	No professional/technical services added; this is State cost.
Contingency (Scope and Bid)		25%			$303	10% Scope, 15% Bid (Low/mid range of recommended values).
TOTAL					$1,513	
TOTAL ANNUAL LUTTRELL REPOSITORY MAINTENANCE O&M COST FOR YEARS 11-30 (STATE OF MONTANA)					$1,500	

PERIODIC COSTS:

DESCRIPTION	WORKSHEET	QTY	UNIT(S)	UNIT COST	TOTAL	NOTES
Five-Year Review Reports	CW-4	1	LS	$12,814	$12,814	Cost is per Five-Year Review Report.
SUBTOTAL					$12,814	
Contingency (Scope and Bid)		20%			$2,563	10% Scope, 10% Bid (Low end of the recommended range).
					$15,377	
Project Management		5%			$769	The low end of the recommended range was used.
Technical Support		10%			$1,538	The low end of the recommended range was used.
TOTAL					$17,684	
TOTAL PERIODIC COST					$17,700	

PRESENT VALUE ANALYSIS:
Table PV-4 provides detailed analysis of present value.

COST TYPE	YEAR(S)	TOTAL COST PER YEAR	DISCOUNT FACTOR (7%)	PRESENT VALUE	NOTES
Capital Cost	0	$3,757,600	1.0000	$3,757,600	Capital (one-time) cost
Luttrell Repository O&M Cost (EPA)	1-10	$10,300	7.0234	$72,341	Annual cost
Luttrell Repository O&M Cost (State of Montana)	11-30	$1,500	5.3853	$8,078	Annual cost
Five-Year Review Cost	5	$17,700	0.7130	$12,620	Periodic cost
Five-Year Review Cost	10	$17,700	0.5083	$8,997	Periodic cost
Five-Year Review Cost	15	$17,700	0.3624	$6,414	Periodic cost
Five-Year Review Cost	20	$17,700	0.2584	$4,574	Periodic cost
Five-Year Review Cost	25	$17,700	0.1842	$3,260	Periodic cost
Five-Year Review Cost	30	$17,700	0.1314	$2,326	Periodic cost
				$3,876,210	
TOTAL PRESENT VALUE OF ALTERNATIVE 4				$3,876,200	

TABLE CS-4

Alternative 4
REMOVAL/TRANSPORTATION/DISPOSAL-LUTTRELL REPOSITORY/INSTITUTIONAL CONTROLS

COST ESTIMATE SUMMARY

Site:	Town of Basin (	Descriptic	Alternative 4 involves the excavation of the contaminated residential soils above PRGs in the town of Basin and disposal of these soils
Location:	Basin, Monta		Excavations will be backfilled with fill and growth media, and revegetated (assumed sodding). Mine waste will also be excavated in the
Phase:	Feasibility Study (-30% to +50%)		of at the Luttrell Repository. Mine waste excavations will be backfilled with fill and growth media, and revegetated (assumed hydroseed
Base Year:	2000		consisting of proprietary controls will be placed at sites where waste is left in-place. Annual O&M costs include mainte
Date:	February 13, 2001		Periodic costs include Five-Year Review reports that document site conditions and effectiveness of this alternative.

Notes:
Percentages used for indirect costs are based on guidance from Section 5.0 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Total costs presented on this table are rounded to the nearest $100.

Abbreviations:

NA	not applicable
EA	each
QTY	quantity
LS	lump sum

TABLE CW-1

Alternative 4
Capital Cost Sub-Eler
ALTERNATE ACCESS ROAD TO LUTTRELL REPOSITORY

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date:10/17/2000

Checked By: MS Date:10/17/2000

Work Statement:
This sub-element involves the improvement of an existing access road to the Luttrell Repository to bypass Quartz Road in the town of Basin. The road will be improved over a one-mile stretch. Improvements include grading, installation of culverts and

Cost Analysis:
Cost for Installation of Alternate Access Road (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC	CITATION	COMMENTS
Pre-Fill Road Work with D8 Dozer	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$120.00	$120.00	$4,800.00	1.00	1.00	$4,800.00	15%	8%	$5,962	P NA	Cost includes equipment operator.
24" Culverts Along Road Alignment	120	LF	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16.30	$16.30	$1,956.00	1.00	1.00	$1,956.00	15%	8%	$2,429	P NA	Cost includes installation and materials.
Pre-Fill Road Work with CAT 325 Excavator	20	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$120.00	$120.00	$2,880.00	1.00	1.00	$2,880.00	15%	8%	$3,577	P NA	Cost includes equipment operator.
Cattle Guards	3	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,000.00	$2,000.00	$6,000.00	1.00	1.00	$6,000.00	15%	8%	$7,452	P NA	Includes installation.
Road Fill Work with CAT 14G Grader	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$90.00	$90.00	$3,600.00	1.00	1.00	$3,600.00	15%	8%	$4,471	P NA	Cost includes equipment operator.
Road Mix Placement	1300	LCY	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$15.50	$15.50	$20,150.00	1.00	1.00	$20,150.00	15%	8%	$25,026	P NA	20' wide, 4 inches thick, includes labor, equipment, mat
Road Fill Work with 2.5 CY Loader	40	HR	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$80.00	$80.00	$3,200.00	1.00	1.00	$3,200.00	15%	8%	$3,974	P NA	Cost includes equipment operator.
														TOTAL UNIT COST:			$52,891		

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment)	Work will be non-hazardous. An HPF of 1.0 is used for labor and equipment unit costs.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12).
Area Cost Factor	An AF of 1.13 is used for Montana, except an AF of 1.00 (national unmodified average) is used for local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 5%, and that field office OH is 10%. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	HR	hour
EQUIP	equipment	EA	each
MATL	material	LCY	loose cubic yard
HPF	HTRW productivity factor	LF	linear feet
ADJ LABOR	adjusted labor for HFP		
ADJ EQUIP	adjusted equipment for HFP		
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE CW-4

Alternatives 1, 2, 3, 4, and 5
Periodic Cost Sub-Eler
FIVE-YEAR REVIEW REPORTS

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date:9/28/2000
Checked By: MS Date:9/29/2000

Work Statement:
This sub-element involves the preparation of Five-Year Review reports. Each Five-Year Review report will evaluate the effectiveness of the remedial action based on any analytical data collected during the previous five years and visual observations m

Cost Analysis:
Cost per Five-Year Review Report (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC		CITATION	COMMENTS
Five-Year Review Report Generation	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10,000.00	$10,000.00	$10,000.00	1.00	1.13	$11,300.00	5%	8%	$12,814	P	NA	includes data evaluation, copying, and shipping
														TOTAL UNIT COST:			$12,814			

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment only)	Work will be non-hazardous. An HPF of 1.0 is used for labor and equipment unit costs.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12)
Area Cost Factor	An AF of 1.13 is used for Montana.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	it is assumed that home office OH is 5%, and that no field office OH is included. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	LS	lump sum
EQUIP	equipment		
MATL	material		
HPF	HTRW productivity factor		
ADJ LABOR	adjusted labor for HFP		
ADJ EQUIP	adjusted equipment for HFP		
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE CW-6

Alternatives 2, 3, 4, and 5
Capital Cost Sub-Eler
TEMPORARY ACCESS ROADS FOR WASTE EXCAVATION

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date:9/28/2000
Checked By: MS Date:9/29/2000

Work Statement:
This sub-element involves the installation of temporary roads to access waste piles in remote areas of the site. The temporary roads will be 15' wide and will be covered with 6" of aggregate. Clearing, grubbing, and rough grading are assumed to be r constructed south of Boulder River, 600 LF on the south side of the WWTP and north of Boulder River, and 300 LF from the access road to the east side of the WWTP.

Cost Analysis:
Cost for Installation of Temporary Access Roads (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC		CITATION	COMMENTS
Rough Grading with D6 Dozer for Road	4334	SY	1.00	$0.81	$0.81	$2.39	$2.39	$0.00	$0.00	$3.20	$13,868.80	1.00	1.13	$15,671.74	15%	8%	$19,464	E	17-03-0101	As noted in work statement
Clearing and Grubbing for Road Alignment	1	AC	1.00	$186.92	$186.92	$401.46	$401.46	$0.00	$0.00	$588.38	$588.38	1.00	1.13	$664.87	15%	8%	$826	E	17-01-0103	Medium brush, avg. grub, some trees
Gravel Base - Delivered and Dumped	722	LCY	1.00	$1.52	$1.52	$1.62	$1.62	$18.43	$0.00	$21.57	$15,573.54	1.00	1.13	$17,598.10	15%	8%	$21,857	E	18-01-0102	As noted in work statement
														TOTAL UNIT COST:			$42,147			

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment)	Work will be non-hazardous. An HPF of 1.0 is used for labor and equipment unit costs.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12).
Area Cost Factor	An AF of 1.13 is used for Montana.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 5%, and that field office OH is 10%. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	SY	square yard
EQUIP	equipment	AC	acre
MATL	material	LCY	loose cubic yard
HTRW	HTRW productivity factor	LF	linear feet
ADJ LABOR	adjusted labor for HFP		
ADJ EQUIP	adjusted equipment for HFP		
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE CW-7

Alternatives 2 and 4
Capital Cost Sub-Ele
RESIDENTIAL SOIL REMOVAL, DISPOSAL (LUTTRELL REPOSITORY), AND BACKFILLI

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date:12/1/2000
Checked By: JMM Date:12/1/2000

Work Statement:
This sub-element involves the excavation of residential soil within the town of Basin and disposal of this soil at the Luttrell Repository. The excavations will be backfilled with clean fill and topsoil, and revegetated with sod. The excavations are

Cost Analysis:
Cost for Excavation of Residential Soil and Disposal at Luttrell Repository (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC	CITATION	COMMENTS
Excavate and Load Soil with 0.75 CY Backhoe	2211	BCY	0.95	$1.21	$1.27	$1.27	$1.34	$0.00	$0.37	$2.98	$22,088.68	1.00	1.13	$24,960.21	15%	8%	$31,001	C 02-315-400-0360	Wheel-mounted, "Other" cost is for loading on truck
Hauling Soil to Luttrell Repository	8893	LCY	0.95	$0.00	$0.00	$0.00	$0.00	$0.00	$9.00	$9.00	$80,037.00	1.00	1.13	$90,441.81	15%	8%	$112,329	V NA	$0.60/CY/loaded mile, 15 loaded miles, est. cost per
Disposal at Luttrell Repository	8893	LCY	0.95	$0.00	$0.00	$0.00	$0.00	$0.00	$5.00	$5.00	$44,465.00	1.00	1.00	$44,465.00	15%	8%	$55,226	V NA	$1,000,000 per 200,000 CY, cost per EPA
														TOTAL UNIT COST:			$198,556		

Cost Analysis:
Cost for Backfilling and Sodding Residential Excavations (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC	CITATION	COMMENTS
18" Protective Cover Layer, Unclassified Fill	6677	LCY	0.95	$0.86	$0.91	$1.98	$2.08	$5.06	$0.00	$8.05	$53,698.04	1.00	1.13	$60,678.78	15%	8%	$75,363	E 17-03-0423	Offsite borrow source, delivered
6" Topsoil Layer	1853	LCY	1.00	$0.64	$0.64	$2.22	$2.22	$13.10	$0.00	$15.96	$29,573.88	1.00	1.13	$33,418.48	15%	8%	$41,506	C 02-920-340-5200	Topsoil delivered, spread by articulated loader, 75 HP
Sod, Vegetative Cover	2.3	AC	1.00	$5,524.00	$5,524.00	$1,352.00	$1,352.00	$15,026.00	$0.00	$21,902.00	$50,374.60	1.00	1.13	$56,923.30	15%	8%	$70,699	E 18-05-0405	Sodding includes watering by truck
Fertilize, 800 Lbs/Acre, Push Rotary	2.3	AC	1.00	$25.49	$25.49	$19.58	$19.58	$35.41	$0.00	$80.48	$185.10	1.00	1.13	$209.17	15%	8%	$260	E 18-05-0409	
														TOTAL UNIT COST:			$187,828		

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment)	Field work will be in Level "D" PPE. An HPF of 0.95 is used for labor and equipment unit costs that occur in contaminated areas.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12).
Area Cost Factor	An AF of 1.13 is used for Montana, except an AF of 1.00 (national unmodified average) is used for local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 5%, and field office OH is 10%. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	AC	acre
EQUIP	equipment	BCY	bank cubic yard
MATL	material	LCY	loose cubic yard
HPF	HTRW productivity factor	LBS	pounds
ADJ LABOR	adjusted labor for HFP	HP	horsepower
ADJ EQUIP	adjusted equipment for HFP		
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE CW-10

Alternative 4
Capital Cost Sub-Eler
MINE WASTE REMOVAL, DISPOSAL (LUTTRELL REPOSITORY), AND BACKFILLING

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date 2/13/2001
Checked By: JMM Date 2/13/2001

Work Statement:
This sub-element involves the excavation of mine waste within the town of Basin and disposal of this waste at the Luttrell Repository. The excavations are assumed to be completed at the Maintenance Yard, the Basin Street Tailings, the Ore Pile, the Jil River. The excavations will be backfilled with clean fill and topsoil, and revegetated using hydroseeding.

Cost Analysis:
Cost for Excavation of Mine Waste and Disposal at Luttrell Repository (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC		CITATION	COMMENTS
Clearing and Grubbing for Waste Excavation	10.3	AC	0.95	$186.92	$196.76	$401.46	$422.59	$0.00	$0.00	$619.35	$6,379.28	1.00	1.13	$7,208.58	15%	8%	$8,953	E	17-01-0103	10% of waste area, med. brush, avg. grub, some tree
Excavate Mine Waste, 3 CY Excavator	46443	BCY	0.95	$0.72	$0.76	$1.61	$1.69	$0.00	$0.00	$2.45	$113,907.57	1.00	1.13	$128,715.55	15%	8%	$159,865	E	17-03-0278	Hydraulic crawler-mounted, cost includes loading
Hauling Mine Waste to Luttrell Repository	55730	LCY	0.95	$0.00	$0.00	$0.00	$0.00	$0.00	$9.00	$9.00	$501,570.00	1.00	1.13	$566,774.10	15%	8%	$703,933	V	NA	$0.60/CY/loaded mile, 15 loaded miles, est. cost per
Disposal at Luttrell Repository	55730	LCY	0.95	$0.00	$0.00	$0.00	$0.00	$0.00	$5.00	$5.00	$278,650.00	1.00	1.00	$278,650.00	15%	8%	$346,083	V	NA	$1,000,000 per 200,000 CY, cost per EPA
														TOTAL UNIT COST:			$1,218,834			

Cost Analysis:
Cost for Backfilling and Revegetating Mine Waste Excavations (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC		CITATION	COMMENTS
18" Protective Cover Layer, Unclassified Fill	46388.1	LCY	0.95	$0.86	$0.91	$1.98	$2.08	$5.06	$0.00	$8.05	$365,293.17	1.00	1.13	$412,781.28	15%	8%	$512,674	E	17-03-0423	Offsite borrow source, delivered
6" Topsoil Layer	8338	LCY	1.00	$0.64	$0.64	$2.22	$2.22	$13.10	$0.00	$15.96	$133,074.48	1.00	1.13	$150,374.16	15%	8%	$186,765	C	02-920-340-5200	Topsoil delivered, spread by articulated loader, 75 HI
Hydroseeding, Vegetative Cover	10.3	AC	1.00	$64.10	$64.10	$88.11	$88.11	$325.70	$0.00	$477.91	$4,922.47	1.00	1.13	$5,562.39	15%	8%	$6,908	E	18-05-0401	67% level, 33% slope, includes mulch.
Fertilize Vegetative Cover, Hydro Spread	10.3	AC	1.00	$25.29	$25.29	$28.38	$28.38	$87.12	$0.00	$140.79	$1,450.14	1.00	1.13	$1,638.65	15%	8%	$2,035	E	18-05-0408	35 Lbs/1000 SF
														TOTAL UNIT COST:			$708,382			

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Devloping and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment)	Field work will be in Level "D" PPE. An HPF of 0.95 is used for labor and equipment unit costs that occur in contaminated areas.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12).
Area Cost Factor	An AF of 1.13 is used for Montana, except an AF of 1.00 (national unmodified average) is used for local vendor quotes.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 5%, and field office OH is 10%. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	AC	acre
EQUIP	equipment	BCY	bank cubic yard
MATL	material	LCY	loose cubic yard
HPF	HTRW productivity factor	Lbs	pounds
ADJ LABOR	adjusted labor for HFP	SF	square feet
ADJ EQUIP	adjusted equipment for HFP	HP	horsepower
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE CW-17

Alternatives 2, 3, 4, and 5
Capital Cost Sub-Eler
MOBILIZATION/DEMOBILIZATION

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date:10/12/2000
Checked By: MS Date:10/12/2000

Work Statement:
This sub-element involves the mobilization and demobilization of heavy equipment and tools to and from the Town of Basin OU1 site. It is assumed that the prime contractor will be located within 50 miles of the site, so no per diem is include

Cost Analysis:
Cost for Mobilization and Demobilization (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC	CITATION	COMMENTS
Mobilize/Demobilize Heavy Equipment	8	EA	1.00	$30.50	$30.50	$153.00	$153.00	$0.00	$0.00	$183.50	$1,468.00	1.00	1.13	$1,658.84	15%	8%	$2,060	C 02-305-250-0020	Up to 50 miles for dozers, loaders, backhoes, excavato
Delivery Charge for Small Equipment	1	EA	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$100.00	$100.00	$100.00	1.00	1.13	$113.00	15%	8%	$140	C 02-305-250-1150	For delivery of hand-held tools and misc. small equipme
														TOTAL UNIT COST:			$2,200		

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment)	Work will be non-hazardous. An HPF of 1.0 is used for labor and equipment unit costs.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12).
Area Cost Factor	An AF of 1.13 is used for Montana.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 5%, and field office OH is 10%. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	EA	each
EQUIP	equipment		
MATL	material		
HPF	HTRW productivity factor		
ADJ LABOR	adjusted labor for HPF		
ADJ EQUIP	adjusted equipment for HPF		
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE CW-18

Alternatives 2, 3, 4, and 5
Capital Cost Sub-Eler
MISCELLANEOUS REQUIREMENTS

COST WORKSHEET

Site: Town of Basin (
Location: Basin, Monta
Phase: Feasibility Study (-30% to +50%)
Base Year: 200C

Prepared By: GLH Date:10/12/2000

Checked By: MS Date:10/12/2000

Work Statement:
This sub-element includes all miscellaneous tasks and items that are required for completion of the alternative, and are not included under other cost worksheet tasks or field office overhead. Items included in this sub-element include contractor work

Cost Analysis:
Cost for Miscellaneous Requirements (Lump Sum)

DESCRIPTION	QTY	UNIT(S)	HPF	LABOR	ADJ LABOR	EQUIP	ADJ EQUIP	MATL	OTHER	UNMOD UC	UNMOD LIC	EF	AF	UNBUR LIC	PC OH	PC PF	BUR LIC		CITATION	COMMENTS
Contractor Quality Assurance Plan	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10,500.00	$10,500.00	$10,500.00	1.00	1.13	$11,865.00	15%	8%	$14,736	P	NA	Includes hardcopy deliverables.
Sampling and Analysis Plan	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10,500.00	$10,500.00	$10,500.00	1.00	1.13	$11,865.00	15%	8%	$14,736	P	NA	Includes hardcopy deliverables.
Site Safety and Health Plan	1	LS	1.00	$0.00	$0.00	$0.00	$0.00	$0.00	$10,500.00	$10,500.00	$10,500.00	1.00	1.13	$11,865.00	15%	8%	$14,736	P	NA	Includes hardcopy deliverables.
Silt Fence for Large Mine Waste Excava	2500	LF	0.95	$1.21	$1.27	$0.00	$0.00	$0.60	$0.00	$1.87	$15,926.32	1.00	1.13	$17,996.74	15%	8%	$22,352	E	18-05-0206	Viny1, 3' high, 7.5' posts, for WWTP, Jib and Basin Mi
Rental Flatbed Truck for Water Tank Trailer	8	MO	1.00	$180.00	$180.00	$1,325.00	$1,325.00	$0.00	$0.00	$1,505.00	$9,030.00	1.00	1.13	$10,203.90	15%	8%	$12,673	C	01-590-200-5500	Single axle, 3 ton, fuel included.
Water Tank Trailer for Dust Control	6	MO	1.00	$206.00	$206.00	$2,100.00	$2,100.00	$0.00	$0.00	$2,306.00	$13,836.00	1.00	1.13	$15,634.68	15%	8%	$19,418	C	01-590-400-6900	5000 gallon, pumped discharge, water costs not include
Staff Engineer for Schedule Preparation	100	HR	1.00	$29.73	$29.73	$0.00	$0.00	$0.00	$0.00	$29.73	$2,973.00	1.12	1.13	$3,716.25	15%	8%	$4,616	O	99-04-1401	Includes labor for construction schedule revisions.
														TOTAL UNIT COST:			$103,267			

Notes:
Area factor is from Exhibit B-2 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000.
Escalation factor is index from base year of estimate divided by index from year of cost data.
Escalation indices are from Exhibit B-1 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000
HTRW productivity factor is from Exhibit B-3 or B-4 of "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 2000

Source of Cost Data:
NA Not Applicable - costs are from previous work or vendor quote
For citation references, the following sources apply:
O - ECHOS Unit Cost Book 1996; E - ECHOS Unit Cost Book 2000; C - Means CostWorks 2000; P - Based on Previous Work by CDM Federal; V - Vendor Quote

Cost Adjustment Checklist:

FACTOR:	NOTES:
H&S Productivity (labor and equipment)	Field work will be in Level "D" PPE. An HPF of 0.95 is used for labor and equipment unit costs that occur in contaminated areas.
Escalation to Base Year	2000 cost sources are not escalated (EF=1.00). 1996 cost sources are escalated by 12% to 2000 costs (EF=1.12).
Area Cost Factor	An AF of 1.13 is used for Montana.
Subcontractor Overhead and Profit	It is assumed that Subcontractor O&P is either included in the PC O&P or has been factored into vendor quotes or previous work.
Prime Contractor Overhead and Profit	It is assumed that home office OH is 5%, and field office OH is 10%. Profit of 8% is used for the Prime Contractor.

Abbreviations:

QTY	quantity	LS	lump sum
EQUIP	equipment	LF	linear foot
MATL	material	HR	hour
HTRW	HTRW productivity factor		
ADJ LABOR	adjusted labor for HFP		
ADJ EQUIP	adjusted equipment for HFP		
UNMOD UC	unmodified unit cost		
UNMOD LIC	unmodified line item cost		
EF	escalation factor		
AF	area factor		
UNBUR LIC	unburdened line item cost		
PC OH	prime contractor overhead		
PC PF	prime contractor profit		
BUR LIC	burdened line item cost		

TABLE PV-4

PRESENT VALUE ANALYSIS

Alternative 4
Removal/Transportation/Disposal-Luttrell Repository/Institutional Controls

Site: Town of Basin (
Location: Basin, Montana
Phase: Feasibility Study (-30% to +50%)
Base Year: 2000

Year	Capital Costs[1]	Luttrell Repository O&M Costs	General Maintenance O&M Costs	Groundwater Monitoring O&M Costs	Five-Year Review Costs	Total Annual Expenditure[2]	Discount Factor (7%)	Present Value[3]
0	$3,757,600	$0	$0	$0	$0	$3,757,600	1.0000	$3,757,600
1	$0	$10,300	$0	$0	$0	$10,300	0.9346	$9,626
2	$0	$10,300	$0	$0	$0	$10,300	0.8734	$8,996
3	$0	$10,300	$0	$0	$0	$10,300	0.8163	$8,408
4	$0	$10,300	$0	$0	$0	$10,300	0.7629	$7,858
5	$0	$10,300	$0	$0	$17,700	$28,000	0.7130	$19,964
6	$0	$10,300	$0	$0	$0	$10,300	0.6663	$6,863
7	$0	$10,300	$0	$0	$0	$10,300	0.6227	$6,414
8	$0	$10,300	$0	$0	$0	$10,300	0.5820	$5,995
9	$0	$10,300	$0	$0	$0	$10,300	0.5439	$5,602
10	$0	$10,300	$0	$0	$17,700	$28,000	0.5083	$14,232
11	$0	$1,500	$0	$0	$0	$1,500	0.4751	$713
12	$0	$1,500	$0	$0	$0	$1,500	0.4440	$666
13	$0	$1,500	$0	$0	$0	$1,500	0.4150	$623
14	$0	$1,500	$0	$0	$0	$1,500	0.3878	$582
15	$0	$1,500	$0	$0	$17,700	$19,200	0.3624	$6,958
16	$0	$1,500	$0	$0	$0	$1,500	0.3387	$508
17	$0	$1,500	$0	$0	$0	$1,500	0.3166	$475
18	$0	$1,500	$0	$0	$0	$1,500	0.2959	$444
19	$0	$1,500	$0	$0	$0	$1,500	0.2765	$415
20	$0	$1,500	$0	$0	$17,700	$19,200	0.2584	$4,961
21	$0	$1,500	$0	$0	$0	$1,500	0.2415	$362
22	$0	$1,500	$0	$0	$0	$1,500	0.2257	$339
23	$0	$1,500	$0	$0	$0	$1,500	0.2109	$316
24	$0	$1,500	$0	$0	$0	$1,500	0.1971	$296
25	$0	$1,500	$0	$0	$17,700	$19,200	0.1842	$3,537
26	$0	$1,500	$0	$0	$0	$1,500	0.1722	$258
27	$0	$1,500	$0	$0	$0	$1,500	0.1609	$241
28	$0	$1,500	$0	$0	$0	$1,500	0.1504	$226
29	$0	$1,500	$0	$0	$0	$1,500	0.1406	$211
30	$0	$1,500	$0	$0	$17,700	$19,200	0.1314	$2,523
TOTALS:	$3,757,600	$133,000	$0	$0	$106,200	$3,996,800		$3,876,212
TOTAL PRESENT VALUE OF ALTERNATIVE 4[4]								$3,876,200

Notes:

1 Capital costs, for purposes of this analysis, are assumed to occur in Year 0.

2 Total annual expenditure is the total cost per year with no discounting.

3 Present value is the total cost per year including a 7% discount factor for that year.

4 Total present value is rounded to the nearest $100.